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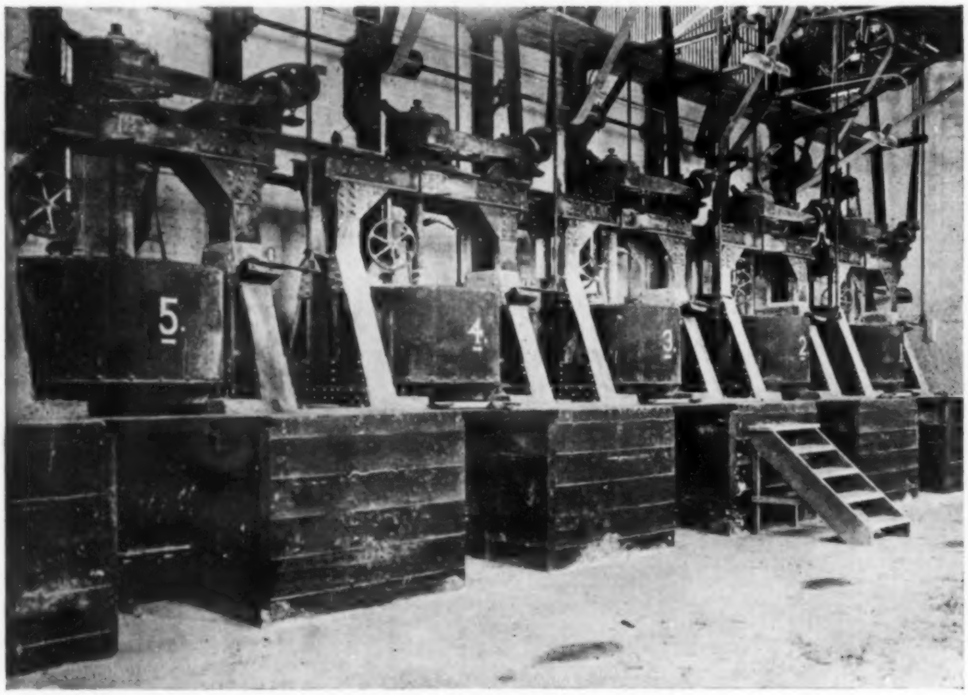

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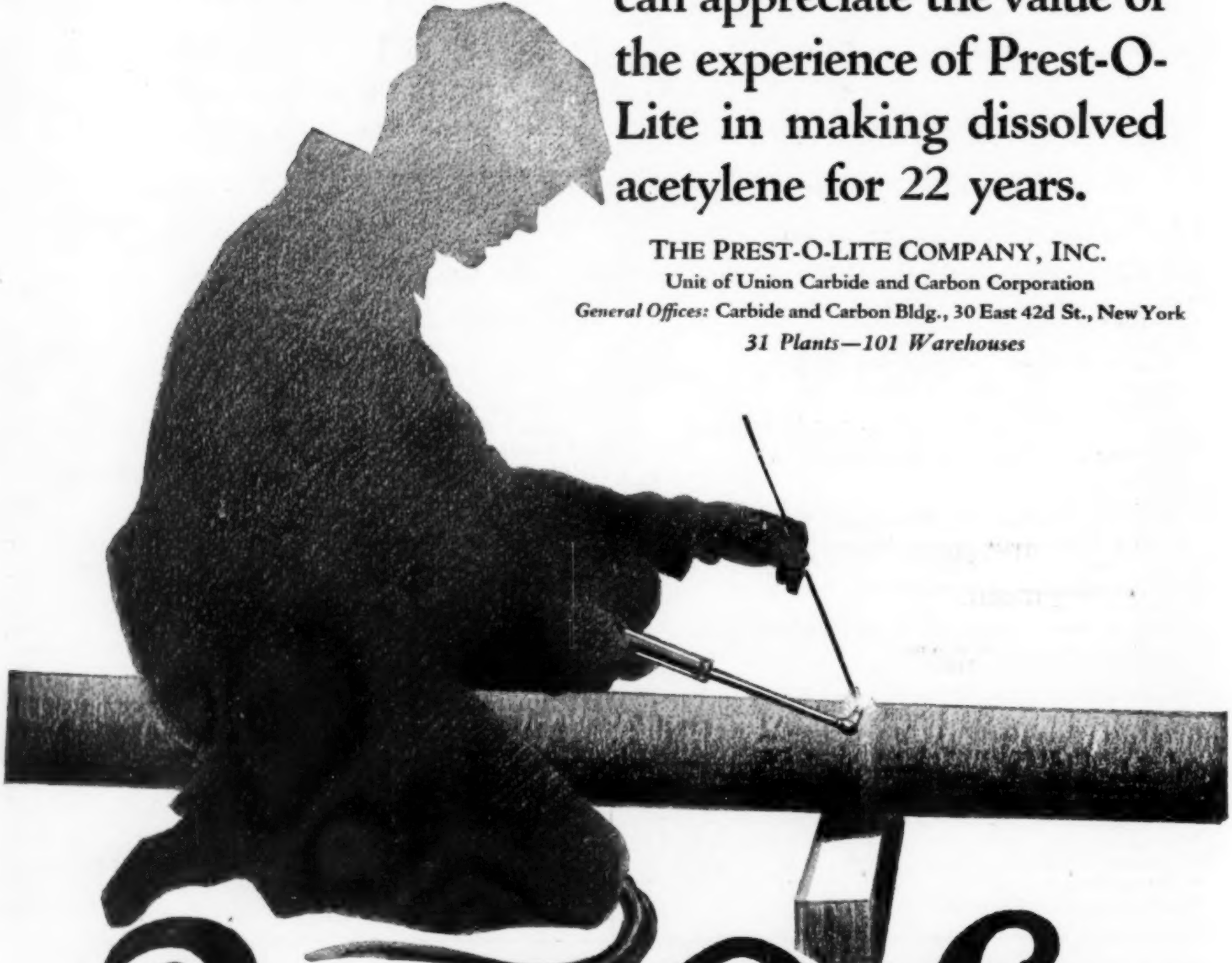

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CHEMICAL & METALLURGICAL ENGINEERING

H. C. Parmelee
Editor

Volume 34 New York, March, 1927 Number 3

A New Protagonist Enters the Lists

DISPLAYING sagacity as well as his recognized gifts of imagination and epigrammatic writing, H. G. Wells recently contributed to the *New York Times* magazine an article that should hearten scientists and engineers even though it may depress professional soldiers of the old school. He inquires, pertinently or impertinently depending on your viewpoint, "Are armies needed any longer?" and answers his question with an implied negative by paying tribute to gas warfare and airplanes, chemical engineering and aeronautics. "Cavalry," he says, "is at last at a discount"; and he finds "no more use for drilled troops than there is for the Greek phalanx."

MR. WELLS praises that much abused institution, the Senate of the United States, for its courage in casting out the so-called Geneva protocol against gas warfare, which "somebody from America agreed to," and which he regards as "a very silly and mischievous treaty." Not only would he preserve gas warfare, but he favors making the available methods of warfare as "perplexing and unpleasant" as possible because under such conditions the world is less likely to get into another disastrous war. Sentiment against warfare of any sort is increasing among humankind generally and particularly in financial and industrial circles. Cherish the thought. And at the same time give science full sway in the advancement of belligerent art, thus increasing the probability that "the improvement of war may be synonomous with the ending of war."

WITH military experts as a class Mr. Wells has little patience. He prefers to rely upon civilian scientists and engineers "who have given their minds to biology, chemistry, mechanics and suchlike sensible pursuits." This keeps them progressive and up to date, whereas professional soldiery, in the British Army at least, "is working out methods of fighting that are not much more than twenty years behind the level of contemporary thought and intelligence." As for chemical warfare, Mr. Wells opines that J. B. S. Haldane, for example, "knows about ten times as much in this field as most of the worthy gentlemen in gold lace, tabs, badges, labels, swords, belts and suchlike adornments who would in practice have to mismanage it."

ANYONE who senses the potency of science and engineering in modern industrial development will find it difficult to disagree with Mr. Wells. For the forces that now turn the wheels of industry would also turn the tide of battle. The talent and ingenuity that now find expression in peaceful productivity would, if mobilized and given free rein, yield startling methods of offense and defense. It is the vision and logic of such possibilities that lead Mr. Wells to say that "the evolution of war is abolishing the soldier altogether."

IN the meantime, however, slavery to tradition in the United States sanctions large appropriations for oats and small ones, if any, for research on gases and masks. Here and there in the military establishment we find a comprehension of what science has to offer to make war intolerable, but the majority "set their faces against all disturbing novelties that would oblige them to learn their trade anew." Mr. Wells is a welcome addition to the vocal supporters of the minority.

What Congress Did —and Did Not

ON MARCH 4 the 69th Congress passed into history, unmourned save by the few whose interest would perhaps have been served had the session been continued, permitting the Senate to act upon pending measures next in line for consideration. In general, this Congress was one of rather unstatesmanlike reputation, but it has to its credit a considerable number of important and much needed achievements in legislation in addition to its major sins of omission and commission.

Much time was devoted by both houses and their committees to questions of Muscle Shoals and like water-power projects. Congress left the Muscle Shoals project just where it found it and in just the same economic status, except that it now appears largely a controversial issue between electrochemical and public-utility users of power, rather than an agricultural and fertilizer project per se.

In the first session of the 69th Congress material tax revision and tax reduction was accomplished; but the final session closed without further changes of this character. It is planned, however, that agents of the Ways and Means Committee shall study tax revision and the administrative features of the tariff law during the coming summer. The committe will then convene in October or early November and draft a bill which can receive legislative consideration early in the first session of the 70th Congress.

The industrial patent situation was favorably affected by three important measures enacted. In one of these acts the number of appeals for final settlement of patent controversies was reduced; in another bill a large increase in the staff of examiners-in-chief was made; and a third measure provided for an enlarged Court of Customs and Patents Appeals which will bring patent controversies before jurists specially fitted to try such cases. The Senate refused to enact legislation proposing to extend beyond 17 years the life of patents held by ex-service men.

During the last session Congress recognized the need for further commercial service abroad and legalized and extended the foreign trade service of the Bureau of Foreign and Domestic Commerce. It also authorized the executive departments to provide for representation at the proposed economic conference in Geneva, but money for participation was not provided. Due to vigorous and persistent opposition in the Senate the Geneva protocol, outlawing gas warfare, was recommitted to the Senate Committee on Foreign Affairs where it reposed at the end of the session in a comatose condition. Whether the political pulmotor will be applied, permitting reconsideration of this proposed treaty in the 70th Congress, is still doubtful.

In the field of mining and mineral industries the last Congress was notable for its lack of action on any feature of coal regulation. It also provided practically no new money for mining investigations or economic studies of mineral supply, and it firmly declined to extend the provisions of the War Minerals Relief Act, despite insistent efforts by members of Congress from western states. The Congress did provide, however, for exploration in the southwestern states for potash; and during the late weeks of the final session it favorably modified the original potash exploration law, making it feasible to go ahead with core drilling where previously opposition of individual land owners was fatal. The Congress also provided added authority in the Bureau of Mines for investigation and development of helium resources and appropriated generously for this work, providing more than $1,000,000 of new money during the last session.

The proposal to regulate resale prices and provide for maintenance of manufacturers' prices of goods in the hands of wholesalers and retailers failed. It is evident, however, that the Kelly bill to this end will again receive consideration in the next Congress. One bill affecting merchandising of peculiar interest to the chemical industries was a bill regulating and providing special labeling provisions for acids and caustic alkalis. This measure was finally passed by both houses and signed by the President despite vigorous opposition by some of the chemical industries.

Altogether, it is difficult to appraise such a combination of accomplishment, inaction and unseemly procedure by the members of the national legislature. One can not help expressing the hope that the Senate may by more statesmanlike behavior in coming years restore itself to the position which it should fill as the nation's most august and important deliberative body.

Machine Speeds, Output And Good Bearings

EVERY MACHINE has one best speed—a speed at which all factors combine to give the cheapest product of first quality that can be produced in that particular piece of apparatus. What that best speed is does not always become evident until thorough tests have been made. But the cost of such tests is a paying investment if it can make returns in increased production.

In carrying out such tests it often becomes evident that quality can be maintained beyond the speed at which the machine can be run without undue wear. Offhand, one would say that in such cases it is necessary to wait until equipment producers have developed a better machine, one that can safely and efficiently run at speeds that will give the maximum quality production.

However, this is not always the case. In a number of industries, particularly in the manufacture of paper and rubber products, it has been found possible safely to increase machine speeds after changing the bearings to modern anti-friction bearings of the ball or roller types. Because these bearings reduced friction and thus made the machine turn more easily, because the heat generated due to friction was reduced at the same time, because undue wear at high speeds was thus avoided, and because higher speeds attained in this way put no greater strain on machine frames than that encountered at much lower speeds with former types of bearings, it has been possible in these industries to increase output by change of bearings alone.

Such results have not been confined to the two industries cited, but the improved bearing practice has been slow to find acceptance in many industries. Every machine that involves rotation in its operation presents a possible opportunity for running at increased speeds and thus increasing output. Of course, a slight investigation will show that the speed of many machines is governed by other factors, but many cases will be found where a small change in the bearings will return many times its cost in increased production.

Sulphur in Petroleum

SULPHUR is a valuable element—in its place. But when it associates itself with petroleum it becomes the perplexing source of a lot of trouble for the oil refiner. Egloff and Morrell told the recent meeting of the Petroleum Division of the A.I.M.E. that the refining with sulphuric acid of the cracked distillates from high-sulphur crude oils causes an economic loss of 20 per cent of the total volume of the gasoline and at the same time a depreciation in the anti-knock quality of the refined product which exceeds 25 per cent. "It is estimated," they said, "that in order to meet the present government specification of 0.1 per cent of sulphur approximately $50,000,000 will be needlessly lost this year due to this one refining factor alone." The present remedy of blending cracked gasolines with straight-run products of low sulphur content is only a temporary alleviation since the proportion of cracked to straight-run gasoline is constantly increasing. The real remedy, the authors held, was not in blending but in raising the sulphur specification to approximately 0.3 per cent.

Sulphur in petroleum is a matter of concern not only to the refiner and user but also to the chemical industry. Petroleum refining has become the principal market for concentrated sulphuric acid as well as an important outlet for caustic soda, soda ash and litharge. The case of a certain high-sulphur crude oil from California is indicative of the potential requirements. If the 50,000 bbl. per day of cracked gasoline from this particular oil is to be desulphurized to the required 0.1 per cent, about 30 lb. of sulphuric acid per bbl. would be needed or more than 250,000 tons per year. This is, of course, a special case and because of the high loss in volume and anti-knock properties, it would never be practical. However, the average acid consumption for all cracked distillates is from 2 lb. to 8 lb. per barrel while about 0.5 lb. of caustic soda and 0.05 lb. of litharge are also required.

Another and perhaps the most important consideration is the relation that sulphur in petroleum bears to the corrosion problem of the oil refiner. Egloff and Morrell are also responsible for the estimate that the annual economic loss to the oil industry due to corrosion alone amounts to $200,000,000, which is roughly 10 per cent of the total capital investment in American petroleum refineries. More than a thousand technical men are working on the corrosion problem and while real progress is being made, the final solution is still in the distant future. To some it might seem that the simplest method would be to desulphurize the crude oil but 40 years of intensive research has failed to bring forth a cheap, effective method. The impracticability of purely chemical means, such as the Frasch process, is obvious when one considers that 100,000 bbl. of the Californian crude oil just referred to, contains 650,000 lb. of sulphur and to remove this would require approximately 2,000,000 lb. of copper oxide per day. The industry has been forced, therefore, to build equipment to combat the effects rather than to remove the causes of corrosion. But here again, the economic balance enters in. Special metals, notably chromium in the high-chromium steels and chromium-nickel-irons as well as certain non-ferrous alloys have the desired resistance to corrosion but, to date, their costs have been prohibitive to the oil refiner.

Brimstone is decidedly out of place in petroleum. It seems to stand as an undeserved plague to the whole oil industry. But it is a challenge to the chemist and chemical engineer and surely it promises an economic reward that should prove an attractive incentive for its control and ultimate conquest.

Co-operation Planned In Paper and Pulp Research

A MOST UNUSUAL and promising plan has been developed for co-operation in paper and pulp research by the Canadian Pulp and Paper Association, McGill University, and the Canadian Forest Products Laboratory. These three agencies, all interested in fundamental investigations on cellulose chemistry, have pooled their resources in a single project. The result is to be an enlarged research undertaking in a new building the funds for which have been subscribed by the association members.

Canadian paper and pulp manufacturers have been in the forefront of industrial advance during the past decade. They have adopted the latest, the most efficient, and the biggest units for their plants. They have fixed upon a splendid policy of permanent forest maintenance to insure permanent pulp-wood supply. Now they afford us still another evidence of their progressive spirit in this joint research undertaking. The spirit here exhibited shows one good reason why the Canadian producers of paper and pulp have already attained first rank in news-print paper output, having within the last 18 months outstripped even the United States producers in quantity.

The new project contemplates erection on the campus of McGill University of a new building at an estimated total cost for building and equipment of $350,000. This money is definitely assured by subscriptions made through the association. For the operation and maintenance of the building and its staff the association is also pledging substantial support. This has already taken the form of a fund of $70,000 which is expendable for research during the years 1925 to 1927. McGill University is doing its part by contributing the interest from an endowment fund of $200,000 and many of the general and overhead expenses incident to laboratory operation. The Forest Products Laboratory of the Dominion Government has graciously submerged its paper and pulp work in this general project and about $35,000 per year of the laboratory's appropriation, which had been used for the paper and pulp laboratory, will be expended in these joint undertakings for progress in the industry.

Too much credit cannot be given to all parties participating in this work. The evidence of real co-operation shown and the willingness to submerge individual credit and authority in a co-operative plan are both rare and highly commendable. We compliment the three agencies for their official action, and particularly we extend our congratulations to the individuals whose personal efforts have been largely responsible for the successful consummation of this plan, particularly Professor Harold Hibbert, of McGill University; Dr. J. S. Bates chairman of the research section and Mr. Edward Beck Secretary-Manager of the association; and Mr. E. Parke Cameron director of the pulp and paper division of the Forest Products Laboratory. It is fortunate that the project is to go forward under such sympathetic and skillful direction as will be afforded by this group.

Constitutionality of Tariff Protection

MORE THAN four years have elapsed since Congress included the so-called flexible tariff provisions in the Act of 1922—a frank experiment aimed in the general direction of scientific tariff making. The question of the legality of the new measure, however, has been before the courts almost continuously during this period, and it is only within the past fortnight that the slow processes of the law have made their progress apparent. The decision delivered February 24 by Presiding Judge Graham of the United States Court of Customs Appeals not only declared that Section 315 is constitutional and therefore a proper exercise of the power of Congress, but also found a valid basis for those provisions of the law that have as their aim the protection of American industry.

The fact that the case in question involved the collection of an increased duty on imports of barium dioxide is of incidental significance, especially because the majority of the applications under Section 315 have referred to chemical commodities. In this instance, a New York importer had protested against payment of a duty of six cents per pound on barium dioxide, which was imposed after the Presidential proclamation of May 19, 1924, had increased the rate from four cents per pound. The importer's complaint was found unjustified by the U. S. Customs Court, but this decision was appealed on the score (1) that Section 315 of the Tariff Act of 1922 is unconstitutional because it delegates to the President the Congressional powers of taxation and legislation and (2) that Congress under the powers given it by the Constitution could not legislate solely for the protection of domestic industry.

Answering these propositions, the higher court laid down a general rule that Congress had the absolute legislative right to regulate foreign commerce in any way it saw fit—to levy discriminating duties or even to prohibit importation. "It was for Congress to select the means," the Court held, "by which it thought the best interests of the country would be served in encouraging, fostering, and protecting the commerce and industry of the country. Having done so, within constitutional limits, the court will not interfere."

This broad pronouncement marks an important victory for American industry, the more significant because it comes from a tribunal before which the domestic manufacturer had no legal status prior to the act of 1922. The decision will doubtless be appealed to the Supreme Court, but a case carefully built on such sound business principles is not likely to be easily torn down in this final process of adjudication.

Future Competition for Fuel Oil

THAT THE DECLINE in the production of fuel oil, begun several years ago, will continue is indicated by recent studies made by competent petroleum economists.

Reference to a paper entitled "Economic Position of Fuel Oil" by Campbell Osborn and C. J. Deegan of the Marland Oil Co. presented last month before the A.I.M.E. will show how marked is this downward trend. In 1920, fuel oil, the petroleum distillate of the lowest economic value, together with gas oil constituted the raw material for but 6 per cent of the gasoline supply; the remaining 94 per cent was obtained from crude oil by skimming and blending. In 1926, however, 31 per cent of the gasoline came from fuel and gas oils and 69 per cent from skimming and blending. It requires no great imagination to forecast the further effects of converting the distillate of lowest economic value into gasoline, the product of highest economic value.

Without doubt fuel oil will continue to be consumed for certain superior purposes such as the merchant marine and navy. In the competition with coal, a commodity of comparatively great economic stability, fuel oil is losing out. Furthermore, the position of coal is being strengthened by better furnace design and more intelligent handling and preparation of solid fuels. Consequently, it is expected that the refinery demand for fuel oil will determine the price to be paid by other consumers; and with the increasing demand as a charging stock for cracking processes, the industrial plants cannot hope to compete. In fact, the indication is that the differential between fuel oil and gasoline, which in 1922 was 12c. per gallon and in recent years varied from 6¾ to 8c. per gallon, will decrease further until the economic limit of cracking has been reached.

Budgetary Trickery Gains False Economy

REARRANGEMENT of the technical work of the Department of Agriculture is being carried out this year in order better to coördinate research activities in soils, fertilizers, and industrial chemical problems. The purpose originally sought can be strongly commended, for it will make for efficiency to have soil research, soil surveys, soil fertility studies, and nitrogen research in the department brought closer together.

This objective has, however, led to another reorganization affecting primarily the Bureau of Chemistry which is of doubtful value. Research activities are to be joined with fertilizer and soil work in a new Bureau of Chemistry and Soils. The food and drug work will be transferred to the administrative supervision of the director of regulatory work of the department.

It is unfortunate that the agricultural chemical work, so closely related to foods and drugs, should be thus separated. But the new organization has even a more serious aspect. At the insistence of the Bureau of the Budget this new Bureau of Chemistry and Soils will have three parts under three technical executives whose status will be that of *division* chiefs instead of *bureau* chiefs, practically demoting the present incumbents. At the present time the Civil Service Commission has a special committee to consider applicants for the chief of the new bureau.

It is quite evident why this "demotion" is being carried out. The budget bureau knows that by this scheme it can lower the maximum salary legally payable to each grade of employee one step below an adequate figure. Thus the great cause of economy will have been served. But the process involves budgetary trickery which should receive hearty and vigorous condemnation. It is hard enough for the government to get good men in the first place. There is no excuse for making their positions intolerable, or even unattractive, after able men are found. It is evident that government budgetary circles are still far from a real understanding of the value of professional service.

Engineers Wanted With Financial Vision

RECENTLY we took occasion to congratulate a prominent gas engineer upon his election to the presidency of the corporation controlling the concern of which he had been for some time the engineering head. Our congratulations were extended not only because of our personal liking for the man, but also because we welcomed this recognition of a successful engineer. The responsibility which an engineer assumes when he takes such executive position, is made clear by our friend's reply, in which he says:

"The administration of our large utility groups is a problem that I do not think has yet been solved in an entirely satisfactory way. It is true that we do want engineering judgment and the engineering viewpoint; that is, the viewpoint of engineers who have *also* enough imagination to see something of the future and of the possibilities in any given field. Unfortunately most of our engineers have not had the financial training that is necessary to visualize equally well the needs and the possibilities in connection with the tremendous amounts of money which it is taking and will take in the future to finance these great undertakings. And so this coming generation will have to bring up men of broader training, catching them young and pushing them through the mill at a faster rate than has been done in the past, in order to have material for executives who will meet all the requirements."

The responsibility of engineering executives is not confined to utility groups. Any engineer who aspires to high position in any chemical engineering industry will do well to ponder the principles described above.

Employment Contracts

IT IS a debatable question whether, in the employment of chemical engineers, chemists and other technologists, a contract is a desirable feature. Some employers hold that contracts are useless; others insist upon them. Some employees prefer them; others regard them as an abomination; and many sign them as a perfunctory matter. There is no consensus of opinion.

It is for the purpose of illuminating the whole subject of contracts that the American Institute of Chemists will hold a one-day meeting on the subject on March 28, at Yale University, New Haven. The program appears elsewhere in this issue. Excellent speakers have been obtained to present diverse views on the subject, and something worth while should result. Those who are interested will be well repaid for their attendance at the conclave.

Technical Consultants as Business Arbiters

ARBITRATION as a substitute for litigation appears to be the latest successful rôle of the technical consultant.

In a recent issue of the *Textile World,* S. S. Sadtler describes three controversies that were settled satisfactorily by chemists. The controversies involved buyers and sellers of textiles and dyes. Mr. Sadtler's account of one specific case should be of interest:

> A dye was sold under a special name. Considerable money was involved in the purchase, and no complaint was made as to the strength or work performed by the dye; but complaint was made that it was in fact a cheaper and well-known dye and not this special one which would properly cost more.
>
> Suit was brought, but instead of fighting it out before a court, the principals, through their counsel, decided to appoint two chemists who should, if not in entire agreement, select a third one. These three chemists were to act as a technical jury to decide the identity of the color. The two chemists first employed did not fully agree in their opinions, and it became the duty of the third chemist to decide the matter finally. He agreed with the chemist for the seller of the dye and established its identity as a special color—one more expensive to manufacture than the well-known dye. This verdict was accepted by the principals to their mutual satisfaction.

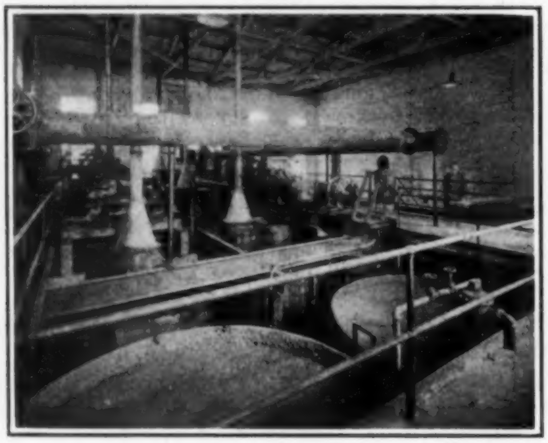
With the increasing complexity of modern business and the frequent need for technical counsel, the principals in a large proportion of disputes between traders in commodities should seek to avoid litigation. Our courts, especially those of higher jurisdiction are so far behind that from one to four years may be required for trial, and even then a final verdict may not be reached. As a constructive step in economy and in the elevation of business practice, technical consultants should more generally arbitrate for their clients.

Ira Remsen, 1846-1927

IN THE PASSING of Ira Remsen we lose another of that narrowing group of pioneers who laid the foundations for the present-day development of chemical science and industry in this country. For more than a half century he worked to bring American chemistry to a position of respect and influence in the world of science. This objective led him to establish the *American Chemical Journal* in 1879, and this desire to develop American chemistry was his inspiration during the thirty-five years he served as its editor and publisher. Strange to say it was the emphasis he laid on the fundamental science in this "organ of pure chemistry" that did so much to bring about its useful application in industry.

Dr. Remsen was a great educator in the original meaning of that word. He "drew out" his students and associates to the full realization of their latent abilities. Accomplishments that have revolutionized industries and have changed the whole course of the development of medicine came from his laboratory with startling frequency. Yet Dr. Remsen never applied for a patent nor otherwise attempted to commercialize his science. Rather he was content to send forth his pupils inspired and equipped for great industrial conquests. Dr. William M. Burton, to whom the petroleum industry is indebted for the commercial application of the cracking process, is one of many in this large group to have publicly acknowledged his debt to the great inspirer. Even in the discovery of saccharin, for which the British Society of Chemical Industry in 1904 gave Dr. Remsen its highest award, the actual finding was made by a student named Fahlberg who was working in Dr. Remsen's laboratory. But Fahlberg would be last to deny that it was the mind if not the hand of the master experimenter that was responsible for the discovery.

Above all else Dr. Remsen was a teacher and for that his fame will long endure. His textbooks, used in the high schools and colleges throughout the country, have introduced chemistry to many thousands and in turn have inspired many hundreds to further pursuit and application of chemical science. His contribution, therefore, lies at the very foundation of the great present structure of American chemistry.

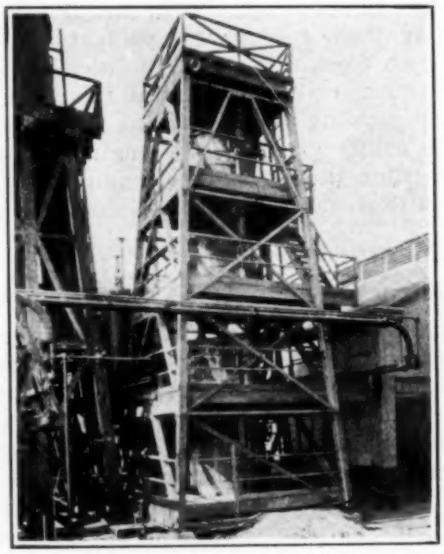


Recovery of Elemental Sulphur in Gas Purification

The left-hand top view shows the emulsifying apparatus at the San Francisco plant of the Pacific Gas & Electric Co., while that at the right, top, is the emulsifying apparatus at the Oakland plant. The picture in the center is the emulsifying tower at the San Jose plant. The two views at the bottom of the page show piles of recovered sulphur, at the left at San Francisco and at the right at San Jose.

These views give a good general idea of the size and type of apparatus used for this process of sulphur recovery and of the appearance of the recovered sulphur. The San Francisco equipment consists of Feld type cone aerators. The Oakland thionizer is a tank with baffles to control the course of flow, in which the solutions bearing sulphur are subjected to a current of air, bubbled up through them from the bottom. The San Jose emulsifier is an outgrowth of the laboratory experiments with an egg-beater, and consists of a series of tanks in which the solution is beaten to a froth by a basket-shaped paddle, thus giving intimate contact with the air.

The sulphur recovered is in an exceedingly finely divided state and is thus particularly suited to agricultural uses, as a soil additive and as an insecticide or fungicide.



Recovery of Sulphur from Gas

Process based on liquid purification recovers material of unusual properties

By K. N. Cundall
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THE PROCESS developed by the Pacific Gas & Electric Co. in 1925, made possible for the first time in the history of the gas industry the economical recovery of saleable sulphur from the gas. This process will remove at the present time up to 98 per cent of the hydrogen sulphide in the gas and oxidize it to free sulphur of a form valuable in agricultural work. The original method of liquid purification as developed by the Koppers Co. forms the basis for the new process.

There was, however, a very serious objection to the original process. When the foul soda solution was revived in the tower through which air was blown, the ill-smelling hydrogen sulphide released to the atmosphere from the stack was noticeable and frequently noxious. For this reason research work was begun in an attempt to find a solution to the problem of correct sulphur disposal or recovery.

The new process developed is based on the catalytic oxidation to free sulphur of the sulphide compounds in the solution leaving the absorber. The absorption of the hydrogen sulphide from the gas is accomplished in the same manner as in the Koppers process, which employs a tower filled with wooden hurdles, 3$\frac{5}{8}$ in. x $\frac{11}{16}$ in., over which a soda solution is sprayed. However, the reactivation of the solution is carried out by the oxidation of the sulphur compounds instead of merely displacing them with air, as done in the old rectifiers. In order to realize this oxidation and precipitation of the sulphur, a new type of activator had to be designed. The sulphur recovered by this process has a wide range of uses but is especially valuable as an insecticide.

Preliminary Studies

The initial trend of chemical research was toward an activator which would revive the foul solution from the absorber without having to discard the products into the air. The early experiments on bone coal and different types of bubbler activators proved the feasibility of the project and the oxidation work was begun.

At this point of the study, the staff was enlarged and a program laid out having the actual recovery of sulphur as the main object. Three possible methods were considered, only one of which was successful. The odorless removal of H_2S was finally accomplished by chemical conversion with sulphur dioxide in the presence of a catalyst according to the reaction,

$$SO_2 + 2H_2S = 3S + 2H_2O$$ (4)

Experiments with this method revealed the astonishing fact that the reaction in the presence of a catalyzer went to completion without the addition of the sulphur dioxide. In other words, the catalyst not only aided the reaction but accelerated the oxidation of the sulphide in the presence of the oxygen alone, the equation for the reaction being:

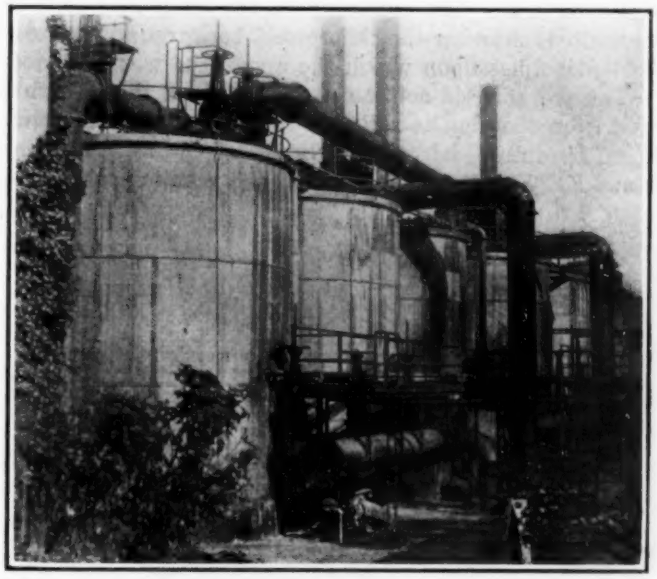


Fig. 1—Absorber System at San Francisco Plant

$$H_2S + \tfrac{1}{2}O_2 = S + H_2O$$ (2)

The catalyst found to be the most active in the reaction was colloidal nickel sulphide, formed from the addition of nickel sulphate to the foul solution.

At this point it was found that the oxidation of the foul purifier solution could be accomplished by creating intimate contact between air (oxygen) and the solution, provided the catalyst be present. The most intimate contact that could be realized was through an emulsion. Using an ordinary egg beater as an emulsifier the collection of data needed for conversion to plant size equipment was begun. Two factors were carefully studied: the rate of reaction, and the principle of application. The first factor gave the effect of different concentrations of catalyst and air, while the second provided the figures from which any size installation could be calculated.

By employing a unique small scale oxidation apparatus, many facts were well established. The results obtained were plotted as the degree of oxidation against time giving characteristic curves, from which the following conclusions were drawn:

1. Increasing the amount of the catalyst increases the slope of the curve, denoting accelerated absorption.
2. Increasing the H_2S content lengthens the curve of the same slope, denoting a longer time of activation.
3. Changes in alkalinity had no effect on the curve, although later experiments show this to be in error.
4. The slope of the curve was unaltered by changes of the ratio of carbonate to bicarbonate.
5. The concentration of neutral salts had no effect.

In all of these experiments variations were obtained which led to the belief that the oxygen was not being brought into intimate enough contact to allow the reaction to proceed at its normal rate. The first apparatus employed to give a better contact and hence more accurate curves was the ordinary hand operated egg beater. Activation under these conditions was very rapid and thus a small single unit of laboratory size was first constructed to be replaced by a 16-gal. drum from which the factors were obtained for a three-stage, superimposed series of tanks, each containing a mechanical stirrer. The evolution of the emulsifier is thus presented, showing the theoretical background and correct principles upon which the apparatus was designed.

The per cent of activation, as obtained through this oxidation reaction is a linear function of the time and could be obtained by a calculation of the reaction constant K. Knowing the order of the reaction, K can be

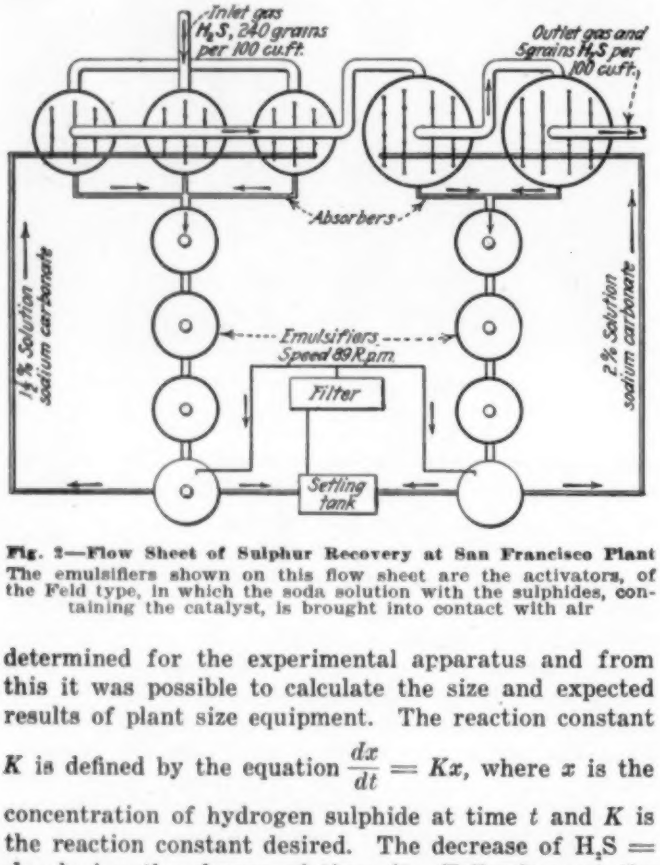


Fig. 2—Flow Sheet of Sulphur Recovery at San Francisco Plant
The emulsifiers shown on this flow sheet are the activators, of the Feld type, in which the soda solution with the sulphides, containing the catalyst, is brought into contact with air

determined for the experimental apparatus and from this it was possible to calculate the size and expected results of plant size equipment. The reaction constant K is defined by the equation $\frac{dx}{dt} = Kx$, where x is the concentration of hydrogen sulphide at time t and K is the reaction constant desired. The decrease of $H_2S = dx$, during the change of time dt. Following out the calculation, integrating and simplifying the expression $ln \frac{x}{x_1} = Kt$ is obtained.

Certain facts have been proven with regard to the constant K:

1. It is independent of the initial concentration H_2S.

2. It is a function of: (a), the amount of catalyst present; (b), the perfection of emulsion or the amount of exposed surface; (c), the temperature. K is therefore an experimental measure of the value of any catalyst with a given apparatus. This factor can be used to show the relative merits of several types of actifiers.

Having studied the conditions affecting the reactions of the process, we can write the equations for the reactions themselves. The soda solution, in contact with the gas in the absorber, picks up H_2S to form the hydrosulphide (NaHS) and sodium bicarborate ($NaHCO_3$), according to the reaction:

$$Na_2CO_3 + H_2S = NaHCO_3 + NaHS$$

A certain equilibrium is established, depending upon the concentrations of the reacting substances and the CO_2 in the gas. This soda solution, heavy with sulphides, leaves the absorber and enters the activator, where the solution containing the catalyst is subjected to intimate contact with air (see Fig. 2). The following reaction takes place and free sulphur is deposited in the solution:

$$NaHCO_3 + NaHS + \tfrac{1}{2}O_2 = S + Na_2CO_3 + H_2O$$

There are two conditions which must be maintained in order to have the above changes take place. They are thoroughness and time of contact. The need for these two conditions was well established during the preliminary chemical study. Any oxidizer which creates close contact between the air catalyst and foul solution for a reasonable period of time will be successful in producing sulphur.

Sodium thiosulphate ($Na_2S_2O_3$) and sodium sulphocyanate (NaSCN) are two compounds formed which accumulate in the solution. These salts continue to form but finally reach a definite concentration due to the loss of solution in the filter.

The nickel catalyst equation should be simple as a true catalyst does not enter into the reaction. In this case, however, some of the nickel is "poisoned" by the hydrogen cyanide in the gas and a complex compound results. This compound was found to be sodium nickelocyanide ($Na_2(Ni(CN)_4)$), which is catalytically inactive and chemically very stable. Thus, a gas containing any appreciable amount of cyanide will poison an equivalent quantity of nickel, thereby causing decreased activation, as the latter is a direct function of the amount of catalyst present up to a known limit.

The general belief among gas men has been that little or no cyanide is present in oil gas. This is certainly not the case, as up to 100 grains of HCN per 100 cu.ft. of gas is ordinarily found at the inlet to the primary scrubbers. Hydrogen cyanide is infinitely soluble in water and its removal by water scrubbing alone is very easy. The high cyanide in Eastern coal gas should not worry the prospective users of the catalytic process of purification, as very little scrubbing is required to remove the cyanide.

New Types of Activator

The absorber system employed in the sulphur recovery process is identical with the original Koppers process and for this reason will not be reviewed. A description will be given of the new type of activator, which treats the foul solution leaving the absorbers via the saturators. From the previously covered study of the reaction and the small scale emulsifiers, three types of oxidizers or activators were developed. These will be designated as follows:

(1) The thionizer or bag type aerator
(2) The Siroco or basket emulsifier
(3) The Feld type emulsifier or cone aerator

Each of these types has been in actual operation as plant equipment for the last six months.

The thionizer type of activator used in the Oakland plant, and shown in Fig. 3, supplies air to the solution

by means of canvas covered perforated pipes placed at the bottom of a series of compartments through which the foul solution flows in a zigzag path. The standard cloth tube aerators are 5 in. in diameter by 5 ft. 6 in. long. Each tube is mounted on a pipe, perforated at intervals for distribution of the air; and this pipe, submerged in the liquid, is connected to an air manifold above the thionizer tank. This arrangement makes it possible to withdraw any one of the tubes for inspection without disturbing the operation of the tank. The arrangement is also such that the solution flows longitudinally over the entire lot of tubes in series, thus giving considerable time of contact.

The volume of air used in the sulphur recovery process is much less than in the original Seaboard method, being about 400 cu.ft. of air per M. cu.ft. of gas. Air entering the blowers goes through air filters which are provided with replaceable filtering media of long life.

The Siroco emulsifier as installed at San Jose, is a superimposed set of four tanks, each fitted with a turbine-driven, basket-type impeller. This device supplies its own air through the sucking action of the whirling blades around the periphery of the wheel. The solution, as shown in Fig. 3, enters in the top tank and flows in series down through the four emulsifiers. The impeller in each of these tanks is made up of a series of lateral blades, placed between an upper and lower steel rim, around which is placed a wire screen. The bottom of the impeller is likewise covered with wire mesh. The rotating of this basket at about 216 r.p.m. causes air to be sucked down into the wheel and then through the screen, giving a foam of minute bubbles throughout the solution. Very little power and no primary air is required for this installation and its ability to produce free sulphur is equally as good as the thionizer.

The San Francisco equipment for sulphur production embraces six Feld type emulsifiers, placed in as many 10,000-gal. tanks. The sulphur produced comes to the top as a foam in an additional tank which acts as a separator. The solution flows through a set of three emulsifiers in series. Two such sets have been in continuous operation for the last six month. In general this machine resembles the Siroco device more than the thionizer but its mechanism is somewhat different. Fig. 4 depicts this aerator as a vertical cone having a 5 deg. taper. It rotates in a tank at a speed of 89 r.p.m. The cone at the top is fitted with two rings of protruding teeth, placed 6 in. apart. These teeth come within 2 in. of the vertical ring of teeth on the bottom of the cylindrical air chamber which extends through the top of the tank and just below the surface of the solution to be activated. Air is forced into this chamber and out through the whirling sets of teeth into a small stack. The action of the cone is to pump the air and solution up through the center and force it through the slot between the teeth. The cone is balanced and hung on a collar and bearing at the top with a guide at the base.

Large capacity is the feature of this Feld type machine, a single 5 ft. 2¾ in. cone in a 13 ft. 3 in. tank at San Francisco consistently activating up to 100 per cent of the foul liquor passing through at a rate of 1,500 gal. per minute.

Having described the three kinds of activators, the results of operation in each plant will be given. It must be kept in mind however that the gas in the Oakland plant travels but once through an absorber, as they are all connected in parallel. In the San Jose plant the two towers are placed in series, while the plant in San Francisco has a three-pass system. These facts are mentioned as the soda consumed varies with the number of passes.

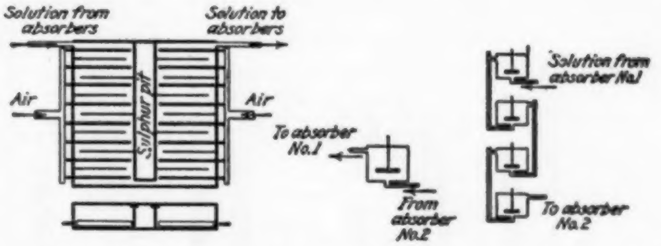


Fig. 3—Activators in Use at the Oakland and San Jose Plants
On the left is the emulsifier or activator at Oakland, while that at San Jose appears on the right

Data and Results of Operation (Jan. to April Incl.)

	H_2S Absorbed Per Cent	Soda Consumed per M. Cu.Ft. Gas Purified	Soda Consumed per Lb. H_2S Removed	Nickel Salt Used per M. Cu.Ft. Gas Purified	Sulphur Produced, Tons
San Francisco	85–100	.141	.480	.023	255
Oakland	70–85	.095	.530	.023	176
San Jose	75–95	.119	.526	.022	26
Denver—average 1925 (Koppers process on water gas)	83.9	.051	.685	None	None

In order to complete the comparison of plants given in the table, the cost of operation in each plant is given. The credit that can be expected from the sale of sulphur is still uncertain, so until this is known the costs will be figured as if no byproduct was being produced. The cost of filtration (about 0.8 mill per M. cu.ft.) is not included, as this could be easily paid by the sale of a small percentage of the sulphur.

The following table gives the operating expenses, including material, labor and power for the three plants:

Cost of Purification in Mills Per Thousand Cu.Ft. (Jan. to April 1926 Incl.)

	Oxide	Liquid	Total
San Jose	2.1	6.5	8.6
Oakland	4.2	6.2	10.4
San Francisco	0.8	7.0	7.8
Denver (Koppers process) Average 1925	...	4.6	4.6

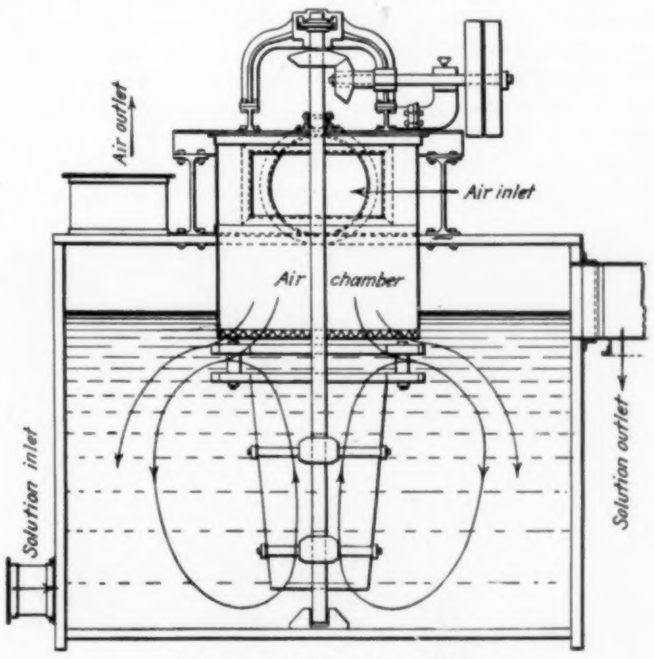


Fig. 4—Feld Type of Emulsifier
This activator or emulsifier is used at the San Francisco plant of the Pacific Gas & Electric Co.

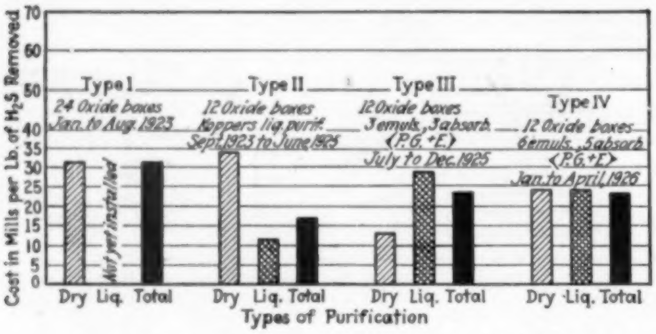


Fig. 5—Comparative Costs of Operation of Oxide and Liquid Purification Systems

These figures, from the San Francisco plant of the Pacific Gas & Electric Co., show operating costs in mills per lb. of H_2S removed

The Denver cost is low, as the raw gas at this plant contains only 62 grains per 100 cu.ft. of gas, against 220 or more for the other plants.

Many questions have been asked regarding the costs of purification using (1) oxide alone, (2) the Koppers plan of liquid purification in conjunction with the oxide and (3) the sulphur recovery process with the oxide. Fig. 5 shows the costs in San Francisco since 1923 and gives very clearly the relative economies of these three types.

Sulphur Separation and Filtration

The separation of the sulphur from the solution is easily accomplished as it forms in the solution a gray, muddy foam which tends to float on the surface in a layer several feet thick. A foam and solution separator was designed, consisting of three rectangular parallel tanks placed together, the solution from the activator entering the middle tank. By means of baffles, the solution flows off at the bottom into the tank on one side, while the sulphur foam is spilled over an adjustable, knife-edged weir into the tank on the other side. This sulphur sludge, containing nearly 30 per cent solids, is then pumped to the filter for further separation of the sulphur.

The usual practice is to continue pumping the sludge to the filter until a cake of about 1½ in. thick has been deposited. The wash water is then admitted and the cake thoroughly washed, after which air is admitted and the cake dried to about 50 per cent water. Fig. 6 shows the sulphur cake just after the filter has been opened and prior to the dumping of the sulphur into a cart below. The washing of the cake is very efficiently carried out as seen by the curve in Fig. 7. This shows the drop in concentration of soda salts in the wash water leaving the cart during the washing and drying period. The washing will return a cake containing about 3 per cent of ash. Of the H_2S removed from the gas, about 85 per cent is recovered as free sulphur.

Fig. 6—Recovered Sulphur on Filter

This view shows the Kelly filter at the San Francisco plant of the Pacific Gas & Electric Co., with a cake of recovery sulphur

Sulphur Disposal

In order to dispose of this new byproduct sulphur, a program of study was mapped out to determine its physical and chemical characteristics. This investigation is not yet concluded, but the results already obtained are sufficiently conclusive to allow of certain deductions. The fact that this sulphur is wetable makes it valuable in the preparations of pastes, suspensions and solutions. It can be dried sufficiently for use in dusting powders and still retains the property of being readily taken into liquid suspension.

The large number of special uses found for this finely divided sulphur are nearly all of an agricultural nature,

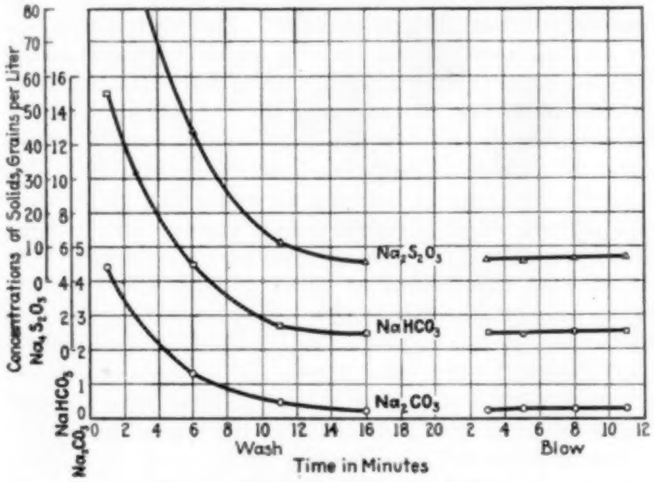


Fig. 7—Washing Efficiency Curves

These curves show the efficiency of washing recovery sulphur on the Kelly filter press and the drop in concentration of soda salts in the water leaving the cart during the washing and drying period

especially in the Western States. It finds employment in the following ways: As an insecticide and as the essential constituent for lime sulphur spray solutions. It is also of great value in potato raising and for counteracting soil alkalinity. In combination with phosphates and some bacteria, sulphur can convert the phosphorus into a plant food. It is valuable against red spiders and in the controlling of mildew.

Actual measurements have been made of the size of this precipitated sulphur and some of the particles are less than 15 microns. Merck's precipitated sulphur gives sizes from 18 to 69 microns, while flowers of sulphur usually run over 100 microns. Due to its size, this recovered sulphur has a high rate of oxidation, which is a valuable feature in soil treatment.

Practically all of the sulphur used in America is marketed as brimstone, from the sulphur deposits of Texas, Nevada and Louisiana. The annual consumption in the United States amounts to more than 1,000,000 tons while, if all the sulphur content in all the artificial gas distributed in the United States were recovered, it would amount to less than ten per cent of this. The present price of brimstone is about $20 per ton. From only three plants on the Pacific Coast, operating for the last six months, there has been produced over 600 tons of sulphur. With further improvement in the process

and its extension to other plants, this company will produce from 2,500 to 3,000 tons of sulphur per year. A fair price for this product will aid materially in keeping the cost of purification of gas within reasonable limits and give to the agriculturist a valuable weapon against devastating insects.

Future Developments

The growing importance of complete gas purification cannot be denied and furthermore, the future purification will be accomplished without the added expense of disposing of the waste product. In its place there will be a recovered waste which when sold, will at least pay for the cost of removal and quite probably return a profit.

The sulphur recovery process has paved the way for other byproduct work, which has already begun in the recovery of sodium thiosulphate and sodium sulphocyanate from the purifying liquor. No doubt before very long, the hydrogen cyanide in the gas will be completely removed by scrubbing and thus eliminate the present loss of catalyst due to combination with the cyanide.

The future control of gas plant operation will mean the technical supervision of a number of highly developed recovery processes, in addition to the care of the well established business of making gas.

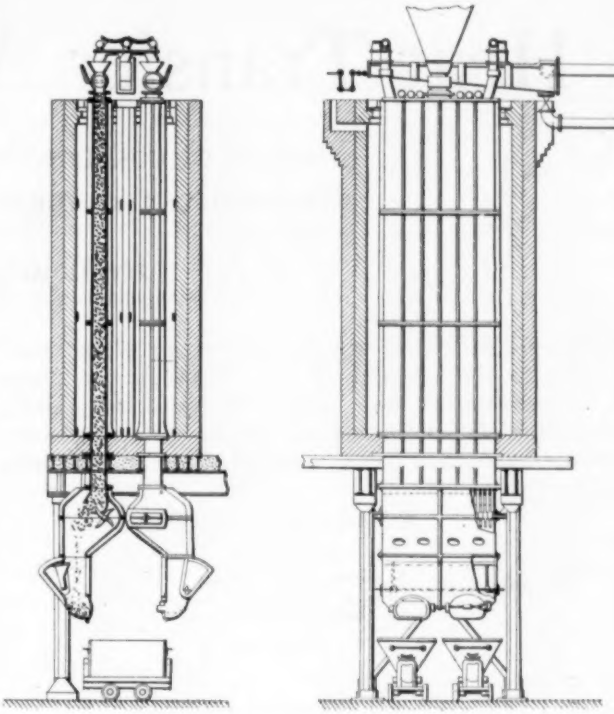
Acknowledgment

The credit for the development of this process might well be laid to the co-operation of the entire organization, and in particular to W. S. Yard, Frank Wills and the writer, of the Pacific Gas & Electric Co., in conjunction with the chemists, L. Rosenstein, F. M. Eaton and R. A. Morgen.

New Low Temperature Retort Tried in England

BRIEF DETAILS of a new low temperature retort, known as type "E," were recently given before a meeting of the Institution of Petroleum Technologists by Dr. C. H. Lander. The retort was heated at Christmas, 1925, and gradually raised to 625 deg. C. in March, 1926, at which temperature it was held until December, 1926, when it was allowed to cool.

A detailed account of the work on these retorts is in preparation and will shortly be published. It was found that a large number of coals, from weak to strongly coking, can be carbonized in this retort. The results shown in the table were given by Dr. Lander.



Details of Type "E" Low Temperature Retort of the British Fuel Research Board

The accompanying drawing, also from Dr. Lander's paper, shows the general arrangement of this type of retort. It consists of two iron boxes, each 21 ft. high, 6 ft. 6 in. x 7 in. cross-section at the top and 6 ft. 10 in. x 11 in. at the bottom.

When the retorts are operated continuously the coal is kept in motion during the whole period of distillation. With intermittent operation the coal is stationary in the retort.

With this latter method, the coke extractor is operated for a few minutes at regular intervals of one or two hours, thus dropping the level of the coke in the retort, which is then filled up with coal and left quiescent until the next charging period. Steam amounting to 10 to 20 per cent of the weight of coal is admitted to the base of the retorts. The swelling coal which has been satisfactorily carbonized in this manner has been in store for some months and may have had its properties modified.

The coke obtained is suitable for most domestic purposes, including open grates. Yields of other products are now under examination.

Results of Tests on Type "E" Low-Temperature Retort

Temp. of setting	Coal	Duration of test	Through-put per retort per day	Gas			Tar in Galls. per Ton	Coke				Remarks
				Cub. Ft. per Ton	Calorific value, B.T.U.	Therms per ton		Cwts. per Ton	Breeze through ½ in. square mesh	Volatile Matter less Moisture		
										On ½ in. square mesh	Through ½ in. square mesh	
Deg. C.		Hrs.	Tons						Per Cent	Per Cent	Per Cent	
620	Nut coal—Mitchell Main (cold)	96	3.52	4,860	729	35.45	13.1	15.30	11.9	8.4	12.3	Retorts charged at 2-hr. intervals; easy working.
625	Nut coal—Mitchell Main (preheated).	96	4.05	4,460	752	33.54	14.31	15.88	11.5	7.3	11.4	Retorts charged at 2-hr. intervals; very easy working.
625	Dalton Main—Nuts through ½-in. 35 to 43 per cent.	74	3.66	5,190	719	37.3	17.3	15.14	17.2	6.6	8.2	Retorts charged at 1-hr. intervals; very easy working
625	Garforth nuts through 1 in. 18 per cent.	72	3.38	6,150	577	35.5	18.4	12.9	19.5	7.7	10.1	Retorts charged at 1-hr. intervals; very easy working.

Heat Transfer Alignment Charts

Method of constructing and using charts for determination of mean temperature difference

By Maurice Roulleux
Bregeat Corporation of America, New York, N. Y.

THE PRACTICAL solution of most problems relating to the transfer of heat between two fluids in circulation and separated by a solid wall, involves the determination of the mean temperature difference as defined below with reference to diagrams *a* and *b*.

Counter Current Flow

Fluid No. 1

Diagram *a* $t_1 \longrightarrow t'_1$

$t_2 \longleftarrow t'_2$

Fluid No. 2

Parallel Flow

Fluid No. 1

Diagram *b* $t_1 \longrightarrow t'_1$

$t_2 \longrightarrow t'_2$

Fluid No. 2

t_1 = temperature of fluid 1 at one end of the heat transfer apparatus
t_2 = temperature of fluid 2 at the same end of the heat transfer apparatus
t'_1 = temperature of fluid 1 at the other end of the heat transfer apparatus
t'_2 = temperature of fluid 2 at the other end of the heat transfer apparatus

The mean temperature difference t_m is given by:

$$t_m = \frac{(t_1 - t_2) - (t'_1 - t'_2)}{ln(t_1 - t_2) - ln(t'_1 - t'_2)} \qquad (1)$$

and is such that the quantity of heat Q transferred per hour, from one fluid to the other, in the heat transfer apparatus, is given by

$$Q = KSt_m \qquad (2)$$

Where S denotes the total area of the wall surface, through which the heat transfer takes place and K is a constant coefficient (i.e., independent of S and t_m) generally called the "heat transfer coefficient" and according to (2) represents the number of heat units transferred from one fluid to the other per hour, per unit of wall surface area and per degree of temperature difference.

These formulas result from the integration of the elementary equation governing the transfer of heat through an infinitesimal area and, under the assumption that neither fluid undergoes any change in its physical properties (excepting its temperature), they are bound to be more general and more accurate in their application than any substitutes.

The calculation of the mean temperature difference according to equation (1) involves, however, the determination of natural logarithms together with subtractions and divisions, and is always a complicated operation requiring the use of logarithm tables.

It is believed that the following contribution will be of interest to all chemical engineers, in that it furnishes a convenient instrument for the instant solution of this problem:

Let us call

$$t_1 - t_2 = t$$
$$t'_1 - t'_2 = t'$$

we can write

$$t_m = \frac{t - t'}{ln\, t - ln\, t'}$$

which can be developed into the equation

$$t_m ln t - t_m ln t' - t + t' = 0$$

which is also equivalent to

$$\begin{vmatrix} 1 & t & ln\ t \\ 1 & t' & ln\ t' \\ 0 & t_m & 1 \end{vmatrix} = 0 \qquad (3)$$

dividing all terms of the first line by lnt, all terms of the second line by lnt', we have the following equivalent equation

$$\begin{vmatrix} \frac{1}{lnt} & \frac{t}{lnt} & 1 \\ \frac{1}{lnt'} & \frac{t'}{lnt'} & 1 \\ 0 & t_m & 1 \end{vmatrix} = 0 \qquad (4)$$

which is tantamount to saying that the three following points are on a straight line

$$\left\{\begin{matrix} x_1 = \frac{1}{lnt} \\ y_1 = \frac{t}{lnt} \end{matrix}\right\} \quad \left\{\begin{matrix} x_2 = \frac{1}{ln\,t'} \\ y_2 = \frac{t'}{ln\,t'} \end{matrix}\right\} \quad \left\{\begin{matrix} x_3 = 0 \\ y_3 = t_m \end{matrix}\right\} \quad (5)\ (6)\ (7)$$

The curve followed by the point x_1y_1 when t varies is the same as that followed by x_2y_2 when t' varies and x_3y_3 follows the ordinate axis when t_m varies.

To every value of t corresponds a point x_1, y_1 (or t) of this curve, as well as to every value of t', corresponds a point x_2y_2 (or t') of the same curve and to every value of t_m corresponds a point on the ordinate axis having t_m as an ordinate. In order to satisfy equation (4) these three points must be on a straight line and reciprocally, if these points are on a straight line they satisfy equation (4).

It is now easy to prepare the curve represented by equation (4) or (5) and to graduate said curve in terms of the values of t (or t'). The ordinate axis can also be graduated in terms of the values of t_m. This has been done in Fig. 1, where the values of t and t_m have been all multiplied by eight for the purpose of convenience. This can be done without changing the alignment property of the diagram, inasmuch as this property holds good for any thermometric scale; multiplying all the indications of the original diagram by eight amounts to taking one-eighth degree as the unit of the final diagram and as the thermometric scale is not determined, the indications of the final diagram are again valid for any scale, whether graduated in terms of degrees Fahrenheit or Centigrade or in terms of

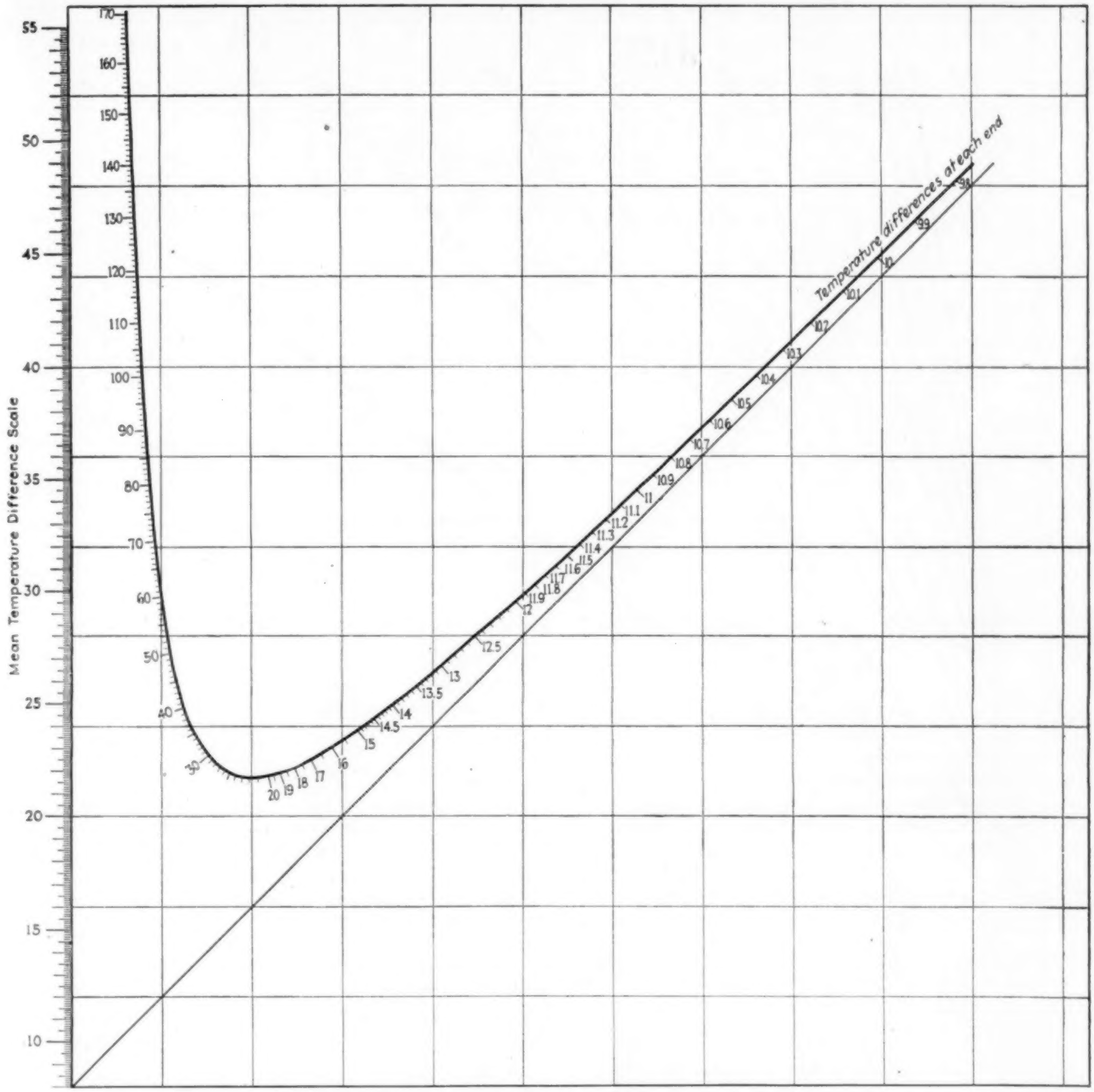


Fig. 1—Chart for Determination of Mean Temperature Differences

any multiple or fraction of one degree of either scale. Therefore, in using the curve, it is perfectly proper to multiply (or divide) the values of both of the known variables by any convenient number, it being understood that the third variable read on the diagram will be multiplied or divided by the same number. This remark is of importance for all cases in which the regular readings do not fall within the range of the diagram and even in some other cases, where the regular reading, using the original values is not convenient to take accurately. Thus, for example:

if $t = 24$ degrees and $t' = 90$ degrees we can read $t_m = 49.8$ degrees at the intersection of the straight line passing through the points 24 and 90 of the curved scale with the straight scale along the ordinate axis; but we can also read $\frac{t_m}{2} = 24.9$ at the intersection of the straight line passing the points $\frac{t}{2} = 12$ and $\frac{t'}{2} = 45$ of the curved scale with the ordinate axis.

Equation (3) may also be modified so as to obtain another form of diagram. Instead of dividing all terms of the first line by $ln\,t$, those of the second line by $ln\,t'$, we may also divide all terms of the first line by t, those of the second line by t' and those of the third line by t_m and obtain the following form of the equation

$$\begin{vmatrix} \frac{1}{t} & 1 & \frac{ln\,t}{t} \\ \frac{1}{t'} & 1 & \frac{ln\,t'}{t'} \\ 0 & 1 & \frac{1}{t_m} \end{vmatrix} = 0$$

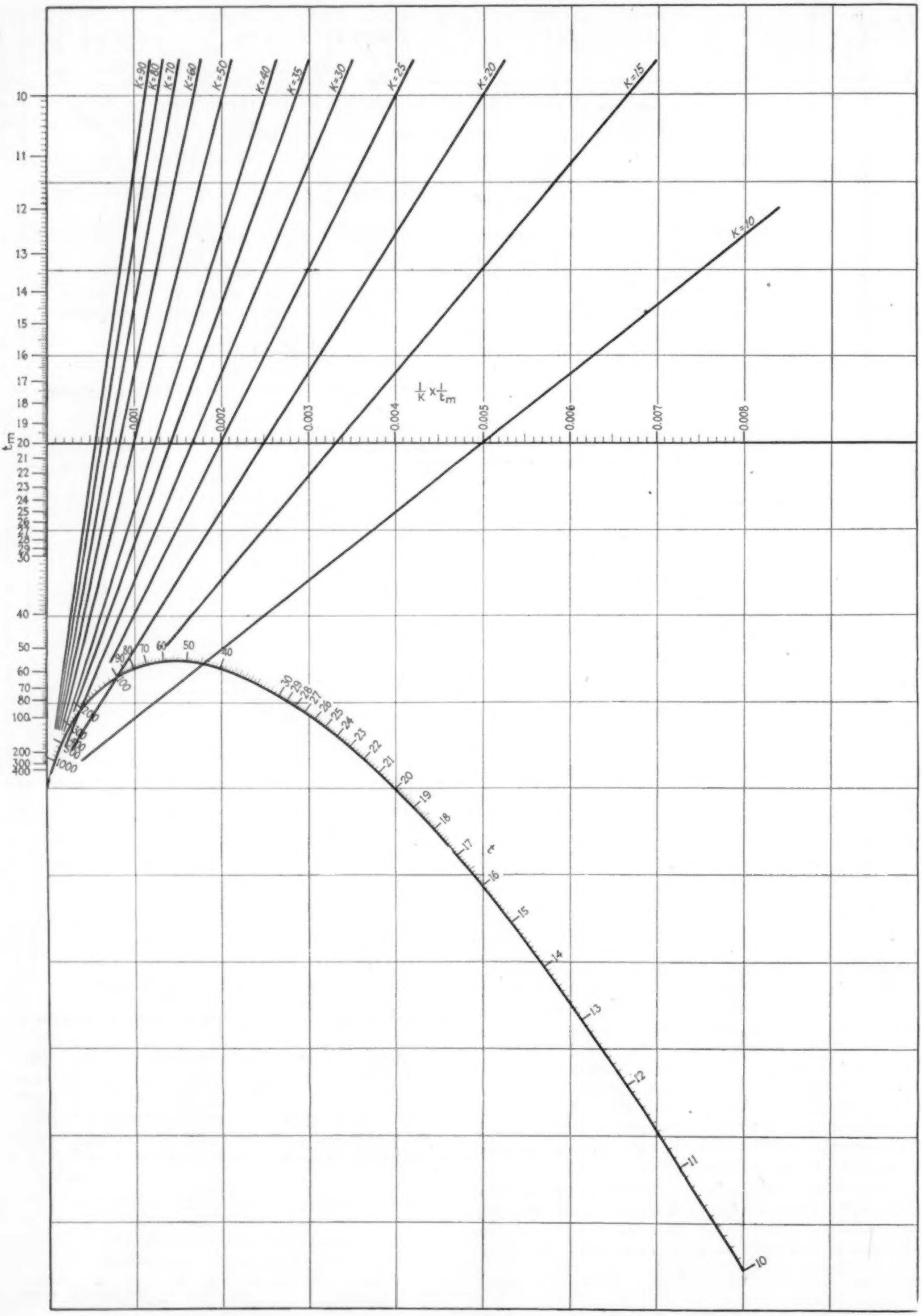


Fig. 2—Chart for Determination of Value of $\frac{1}{K} \times \frac{1}{t_m}$

changing over column 2 to column 3 and vice versa, we get the equivalent form below

$$\begin{vmatrix} \frac{1}{t} & \frac{lnt}{t} & 1 \\ \frac{1}{t'} & \frac{lnt'}{t'} & 1 \\ 0 & \frac{1}{t_m} & 1 \end{vmatrix} = 0 \qquad (8)$$

representing that the three following points are on a straight line

$$\left\{\begin{matrix} x_1 = \frac{1}{t} \\ y_1 = \frac{lnt}{t} \end{matrix}\right\} \left\{\begin{matrix} x_2 = \frac{1}{t'} \\ y_2 = \frac{lnt'}{t'} \end{matrix}\right\} \left\{\begin{matrix} x_3 = 0 \\ y_3 = \frac{1}{t_m} \end{matrix}\right\} \quad (9)\ (10)\ (11)$$

Here, again, the first two points are situated on the same curve, which can easily be graduated in terms of the values of t, while the third point is located on the ordinate axis, at a distance from the origin equal to $\frac{1}{t_m}$ The ordinate axis can be graduated in terms of t_m as shown on Fig. 2.

The most usual heat transfer problem involves the determination of the surface of the heat transfer apparatus by means of equation (2) which is for this purpose, written under the form:

$$S = Q \times \frac{1}{K} \times \frac{1}{t_m}$$

In this connection, it will be convenient to use Fig. 2, in combination with a set of straight lines having the various values of K as their respective angular coefficients and passing through the origin.

The value of $\frac{1}{K_1} \times \frac{1}{t_m}$ is the abscissa (to be read on the horizontal scale) of the point at which the horizontal line drawn through t_m (read on the vertical scale) intersects the straight line marked K.

If, before taking readings, it has been found convenient to multiply (or to divide) all given temperatures by a certain factor A and the given heat transfer coefficient (K) by a certain factor B, the mean temperature difference reading (vertical scale) should be divided (or multiplied) by A, but the reading taken on the horizontal scale of Fig. 2 must be multiplied (or divided) by A and by B in order to furnish the correct value of $\frac{1}{K} \times \frac{1}{t_m}$

Example. Calculate the surface of a heat transfer apparatus to transfer 1,000,000 B.t.u. per hour, under conditions corresponding to the following diagram, with a heat transfer coefficient $K = 150$ B.t.u. per sq.ft. per deg. F., per hour.

$$194 \text{ deg. F.} \longleftarrow 80 \text{ deg. F.}$$
$$140 \text{ deg. F.} \longrightarrow 65 \text{ deg. F.}$$

The temperature differences at each end are 54 deg. F. and 15 deg. F. respectively.

Using Fig. 2, the straight line passing through the graduations 15 deg. and 54 deg. of the curved scale intersects the ordinate axis at a certain point corresponding to the mean temperature difference (which would read 30.4, but which need not be taken). The horizontal line drawn from this last point, intersects the straight line marked $K = 15$ (which is $\frac{1}{10}$ of the given value 150) at a point, the abcissa of which, read on the horizontal scale, gives: 0.00219. Before taking the reading we have divided the given heat exchange coefficient K by 10, therefore the last reading must also be divided by 10, giving 0.000219 as the value of $\frac{1}{K} \times \frac{1}{t_m}$ This figure multiplied by the number of B.t.u. to be transferred per hour, i.e. 1,000,000, will give 219 sq.ft. as the area of the heat transfer surface required.

Compressed Gas Handling Technic

Details of equipment construction designs developed in the course of synthetic ammonia research

By F. A. Ernst

Fixed Nitrogen Research Laboratory, Washington, D. C.

RAPID increase in the volume of compressed gas used in industry has created a demand for the development of a gas handling technic based upon correct engineering design. The synthetic ammonia industry alone is consuming over 150,000,000 cu.ft. of gas ($N_2 + 3H_2$ mixture) per day and is expanding rapidly, while other industrial processes depending upon compressed gas are being developed and put into operation. At present, however, there is no satisfactory technic which is generally available.

It is to be expected that process development should precede equipment development, yet the lag should be small. The equipment manufacturers cannot be expected to develop gas handling equipment unless there is a demand for it and such a demand must come from the gas manufacturer. Not only must there be a demand, but also certain of the conditions of use and the performance requirements must be made known to the designer and fabricator.

The attempts to adapt hydraulic and compressed air equipment to use with compressed gas has in most cases

Abstract of a paper presented before Compressed Gas Manufactures Association, New York City, January 24, 1927.

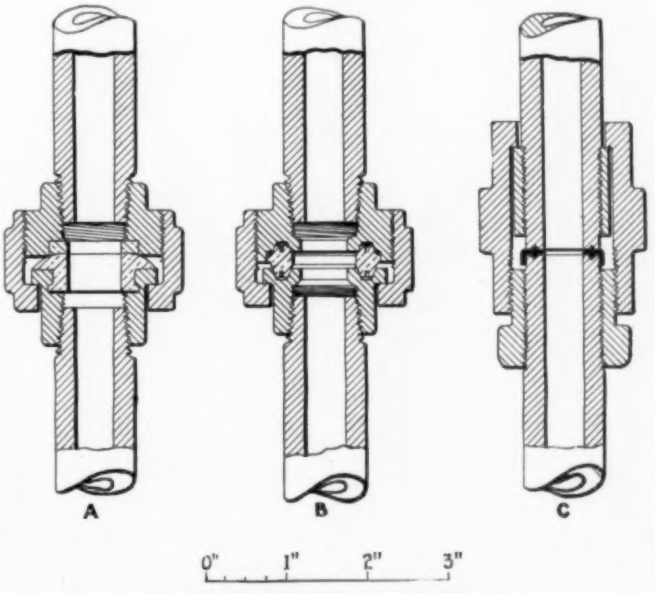


Fig. 1—High Pressure Union Fittings

A and B are commercial types in which the threads must be gas tight; C is a new type in which gas pressure is held by a metal gasket, the threads serving merely to hold the tube ends against the gasket

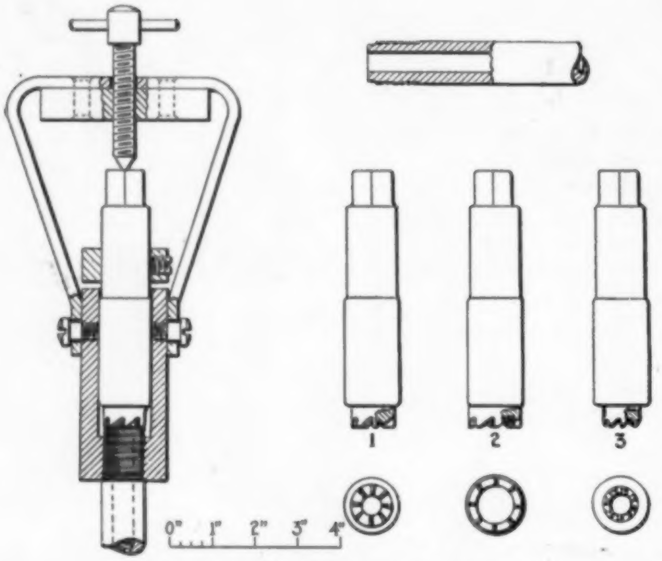


Fig. 2—Tools for Fitting Unions
Tubing end is threaded, screwed into tool holder, and then shaped by tools. (1) is for squaring end, (2) for cutting back threads and (3) for cutting groove for gasket

proved uneconomical and unsatisfactory. In fact, in many cases such practice has proved to be hazardous. Equipment developed at the Fixed Nitrogen Research Laboratory has, on the contrary, been based on information gained through investigations of compressed gas reactions. These designs, briefly described here, are given as suggestions which might be of value in the development of a general compressed gas handling technic.

Alloy-Steel Tubing Economical

Seamless drawn tubing, such as is necessary for the conveyance of compressed gas, is available in such a great variety of sizes that there is size suitable for almost any compressed gas purpose. A selection of the materials of fabrication of the tubing is important and has a bearing on the wall thickness necessary. In one instance, it was found that for a certain internal diameter, and certain conditions, an external diameter of $1\frac{1}{16}$ in. was necessary when a carbon steel tubing was considered. When, however, a chrome-vanadium tubing of the 1 per cent chromium type was considered, the necessary external diameter for the same conditions was 1 in. This difference in wall thickness resulted in a difference of weight per foot of tubing of 50 per cent. That is, the weight of the chrome vanadium tubing was but half of that of the carbon steel tubing. Hence, although the alloy steel tubing cost twice as much per pound as the carbon steel tubing the cost per foot was the same; and the size and consequent cost of fittings for the chrome vanadium tubing was materially less than for the carbon steel tubing. Here the material of higher unit price was not only the more economical but afforded the opportunity for better plant and equipment design.

A large amount of effort has been expended by equipment manufacturers in developing a high pressure union connection. Experience has shown that pipe threads at their best are very unreliable, as a means of holding compressed gas, and that they should not be used. This not only refers to pressures above 100 atmospheres, but also to lower pressures. In the improved type as shown in Fig. 1 the actual gas seal is made at the ends of the tubing by means of a metallic gasket. The machine threads are used only for the purpose of drawing the ends of the two pieces of tubing together and are not exposed to the gas flow at all.

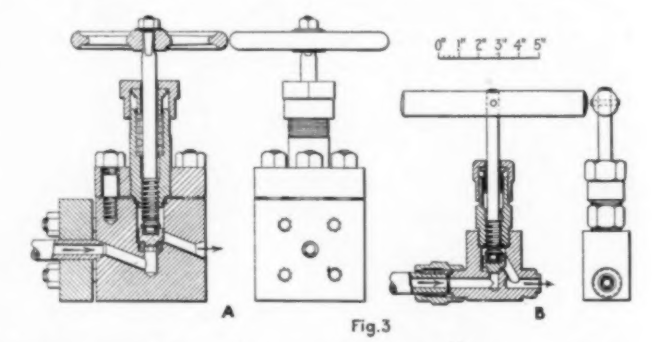
The cost of such a union is no greater than that of the various types of union connections depending upon pipe threads to maintain the compressed gas. Likewise, there is no more difficulty in making up such a connection than in the case of the other type shown. To prepare the tubing for such a union connection, threads may be cut with a hand die. Then with the tool shown in Fig. 2, the ends of the tubing may be easily prepared for the union.

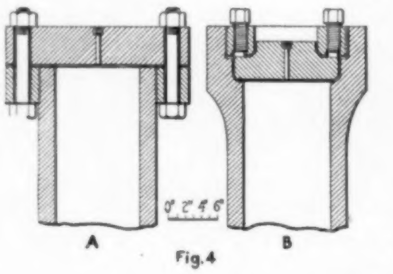
Proper Valve Design Cuts Cost

Fig. 3 shows at "A" a high pressure valve which usually costs about \$35 and at "B" a valve of the same capacity designed specifically for the compressed gas use. Valves of design "B" were secured at a cost of \$10.50 each. Not only did the application of engineering design cut to a third the original cost of the valve, but it also cut the weight from 70 lb. to 11 lb. Lighter weight equipment is of course of as much advantage as is the lower cost.

In Fig. 4, two types of heads for pressure sustaining vessels are shown. A casual study of the two types shows the advantages of the improved type. The ease with which such a head as type 4B can be made tight and removed, is another feature. By the use of interrupted threads in both bolt ring and vessel shell, similar to a gun breech mechanism, it is only necessary in removing the head to loosen the bolts enough to relieve their pressure on the head. Then by giving the bolt ring a circumferential turn equal to the length of the thread, perhaps $\frac{1}{16}$ of the circumference, it can be taken out and the head removed.

It is often necessary to admit an electric lead into a





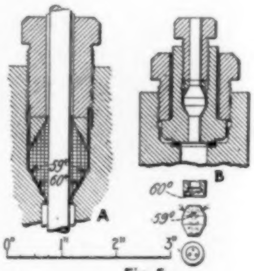


Fig. 3—Two Styles of High Pressure Valves
A is usual form costing \$35 and weighing 70 lb., B costs \$10.50 and weighs 11 lb.

Fig. 4—Reaction Chamber Closure
A is conventional form and B is new design. In B note smaller bolts, in compression instead of tension, and that bolt circle is same as gasket circle, avoiding tendency of head to distortion and consequent troubles

Fig. 5—Insulators on Electric Leads
Type A, of "selected" grade soapstone, has been successful for 1/64 to [illegible] in. diameter leads when accurately cut follower block gives line contact. Type B, of "Transite" board, permits use of multiple leads close together. It has been successfully used at pressures up to 17,500 lb. per sq.in.

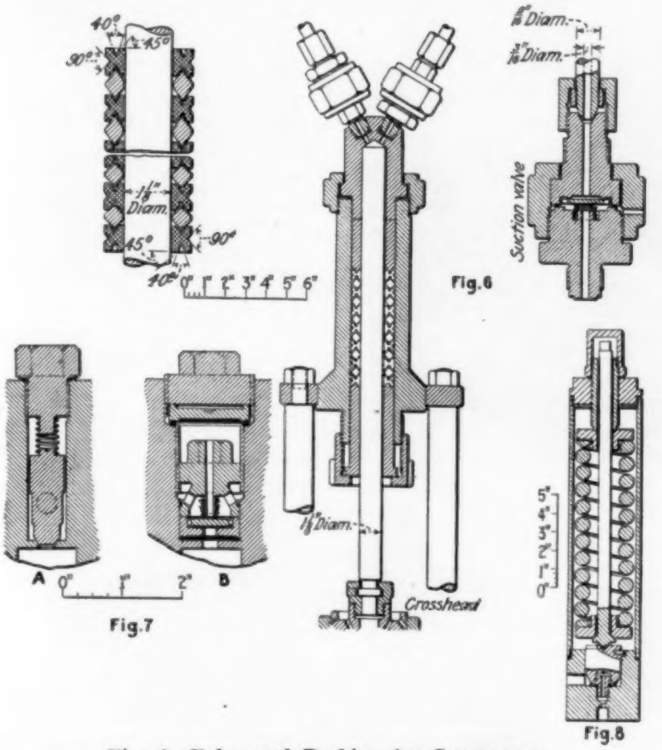


Fig. 6—Valve and Packing for Compressor
Packing (at left) is of alternate rings of babbitt and steel. The valve is of the large diameter disk type with low lift, avoiding water hammer and permitting knife-edge contact with seat

Fig. 7—Valve Seat Construction
Compressor with valves of type **A** became inoperative because valves stuck or failed to seat; with type **B** these troubles were avoided

Fig. 8—High Pressure Relief Valve
The cylindrical valve is movable vertically but cannot rotate. It has a seat 0.01 in. wide on a gasket of softer material with almost line contact

compressed gas chamber. Not only must this lead be insulated from the metal chamber, but the means of insulation must be gas tight. Fig. 5 shows two successful types. The seat and follower ring must be cut so that as pressure is applied by a tightening of the gland, although the tip of the soapstone cone may crumble away, line contact rather than surface contact is maintained. When the joint is properly made, positive gas sealing contact has been found to be made near the small end of the cone.

Heat applied hardens the soapstone and makes if anything a tighter joint. Water, on the other hand, softens the soapstone causing it to blow out; hence if a hydraulic test is desired of a vessel having a soapstone connection, the soapstone should be replaced.

Compressor Packing and Valves

The small pump or booster shown in Fig. 6 is one built at the Fixed Nitrogen Research Laboratory, and used as a circulating pump or booster for gas pressures up to 6,000 lb. per sq.in. The features of this pump offered as suggestions are the packing and valves.

The packing rings are so cut that with pressure applied by either the gland or internal gas pressure, the diamond shaped steel rings tend to force the babbitt rings against the rod. The pressure of the babbitt against the rod for a given packing gland pressure may be varied by varying the contained angle of the edges of the steel ring. This packing has proved very satisfactory, not only for pump and compressor rod packing, but for valve stem packing as well.

In any work with compressed gas, it is very necessary to protect both equipment and personnel by satisfactory relief valves. In many cases, the commercial relief valves at present available are not satisfactory for compressed gas use. With most relief valves, it is necessary to take down the valve for cleaning and regrinding after each relief. Many instances could be cited where in order to avoid this nuisance, such valves have been tampered with to render them incapable of relief. To correct this situation, a relief valve was developed at the Fixed Nitrogen Research Laboratory which will relieve thousands of times and seat perfectly after each relief. Such a valve is shown in Fig. 8. It has been fully described by Ernst and Reed (*Mech. Eng.* 48, 595, 1926).

Citrus Byproducts Industry Makes Progress

The remarkable growth of the citrus byproducts industry which has been developed within the last decade is founded on results of scientific research. Investigations begun about twelve years ago by the Bureau of Chemistry, United States Department of Agriculture, in its branch laboratory at Los Angeles, have resulted in the development of processes for recovering citric acid, as well as other valuable substances such as oil, pectin, juice, and pulp, from oranges and lemons. The commercial application of these processes not only enables the industry to save the fruit that is for one reason or another undesirable for market, but to use marketable fruit at a profit when there is a surplus. Thirty per cent of the production is classed as culls.

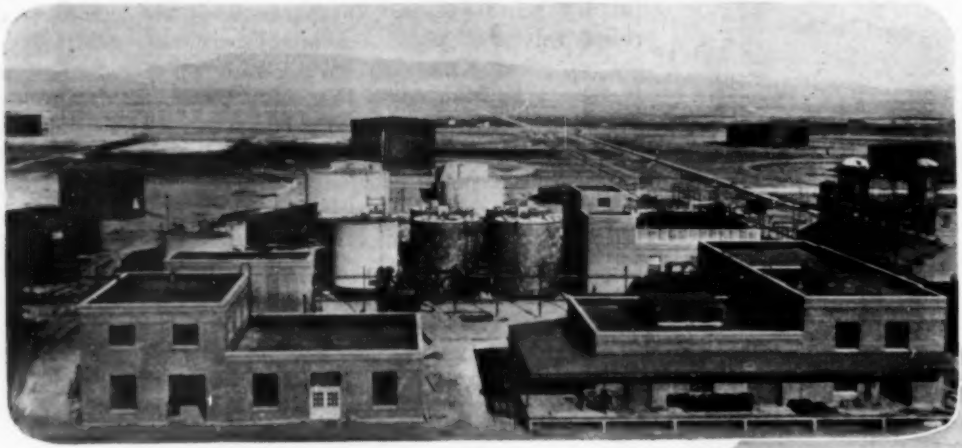
Citrus growers themselves are now operating two byproducts plants, one for lemons at Corona, Calif., and the one for oranges at Ontario, Calif. Commercial concerns are now manufacturing on a profitable scale numerous marketable products from large quantities of cull fruit that would otherwise be a loss to the industry.

One plant last year manufactured approximately 2,000,000 lb. of citric acid, using about 40,000 tons of cull lemons, which returned to the growers a net total of about \$450,000. Another plant produced about 65,000 lb. of lemon oil with a value of approximately \$70,000, as well as 30,000 lb. of pectin.

From waste oranges are manufactured juice, marmalade, pectin, orange oil, and other products. One plant, which used last year 10,000 tons of oranges, put out, among other products, about 50,000 lb. of orange oil having a wholesale value of approximately \$100,000.

One concern has even found a profitable outlet for orange pulp from which the juice has been extracted. The disposal of pulp was once a distinct problem, costing the concern about \$800 a month. It is now prepared as a feed for dairy cattle and sold as wet pulp for about \$3 a ton. The handling of this product instead of being a monthly liability of \$800 now returns the concern a profit of from \$2,500 to \$3,000 a month.

By means of an improved machine to press the oil from orange and lemon peel developed during the past year, at least 5 lb. of oil can be pressed from the peels of a ton of lemons. One concern in Los Angeles uses 60 tons of citrus fruit a day in making juice by means of a revolving burr-type machine. As citrus oils are worth approximately \$2.50 a pound the extraction and utilization of the oil would mean an additional return of \$12.50 for each ton of cull fruit, or on the output of this one plant, a gross additional income of \$750 a day.



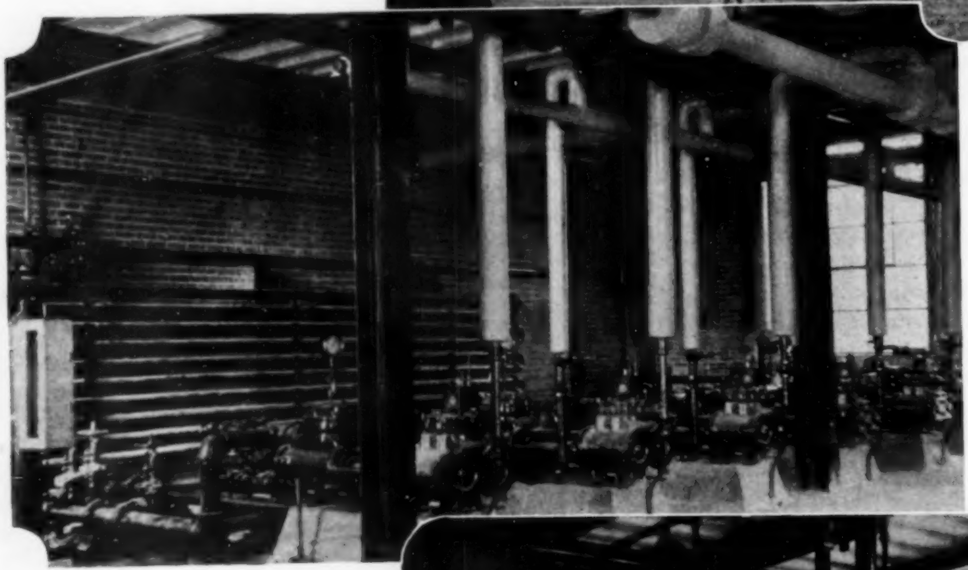
At left. **General View of Lubricating Oil Plant at Parco, Wyoming.**

The contact filter plant is shown in the left foreground. At the right is the combined barrel and compounding house, together with laboratory and office. Behind this building is the Sharples plant.

Contact Filtration of Lubricating Oils

Above. **Exterior of Contact Filtering House.**

The spent clay elevator and storage bin are shown in the foreground.

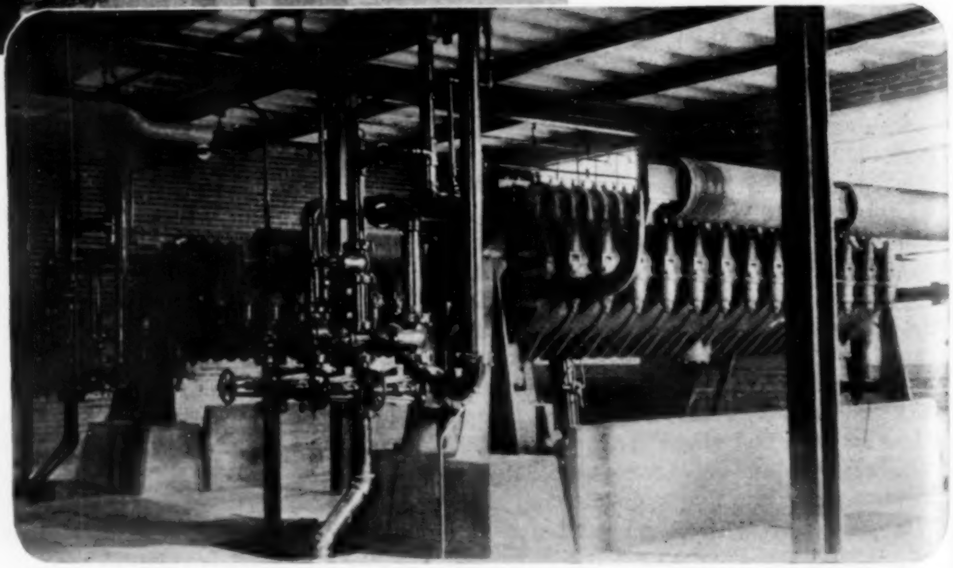


At left. **Pump Room in the Filtering House.**

Brass lined pumps are used to handle the clay-oil mixture. Before filtering the mixture is cooled in the cooling coils shown in the background.

At right. **Filter Presses that Remove the Clay from the Oil.**

The two Sweetland filters shown here are equipped with special Monel metal cloth covered filter frames. There is an arrangement by which the spent filter cake, while still in place, is washed with naphtha in order to keep oil losses at a minimum.



Design and Operation of a Contact Filter Plant

How finely divided clay is used in a modern petroleum refinery in the filtration of lubricating oils

By H. L. Kauffman
Consulting Petroleum Technologist, Denver, Colorado

OF WIDE INTEREST to refiners of petroleum and to chemical engineers in other industries has been the development during the past few years of the so-called "contact process" for the filtering of petroleum products. Briefly, this process involves the mixing, with the aid of heat, of finely-divided filtering materials of high adsorptive value with the oil to be purified and thereafter separating the spent adsorbent from the purified oil by a suitable mechanical means. More recently there has come into prominence a process whereby the purifying agent is an acid-treated clay (of the bentonite type), this being applied to the oil to be purified in the form of a clay-pulp, containing from 25 to 30 per cent of solids. These latter types of adsorbents prove to be, approximately, from five to ten times as efficient as 100-mesh Florida or Georgia fullers earth (used once) and hence an even more extensive use in the future of these highly activated filtering materials can now be predicted.

The present article will describe the contact filtering plant built by the J. G. White Engineering Corporation at the Parco, Wyoming, refinery of Producers and Refiners Corporation. This filtering plant has been in operation, at such times as were required in order to maintain sufficient stocks of lubricating oils on hand, since December, 1924. It represents, to the best of the writer's knowledge, the first contact filtering plant of commercial size built in the United States and upon the operation of which depended the filtering of *all* products that it was found necessary for the refiner to filter. In other words, prior to date of the operation of this plant, all other refiners who had contact filtering plants installed were *also* operating the conventional type of percolation filtering plants.

This article will not discuss any of the advantages and disadvantages of either percolating or contact filtering methods, and for such information the interested reader is referred to previous articles by the writer. ("'Contact Process' for the Filtering of Petroleum Products." *National Petroleum News*, Jan. 17, 1923. "The Role of Adsorption in Petroleum Refining." *Chem. & Met.*, Vol. 30, No. 4, pps. 153-136, Jan. 28, 1924.)

Briefly, the process by which lubricating oil stocks—or so-called "long residuums" and bright stocks—are made at the Parco refinery is as follows:

In the distillation of the crude oil, the gasoline, kerosene, gas oil and part of the wax distillate fraction are

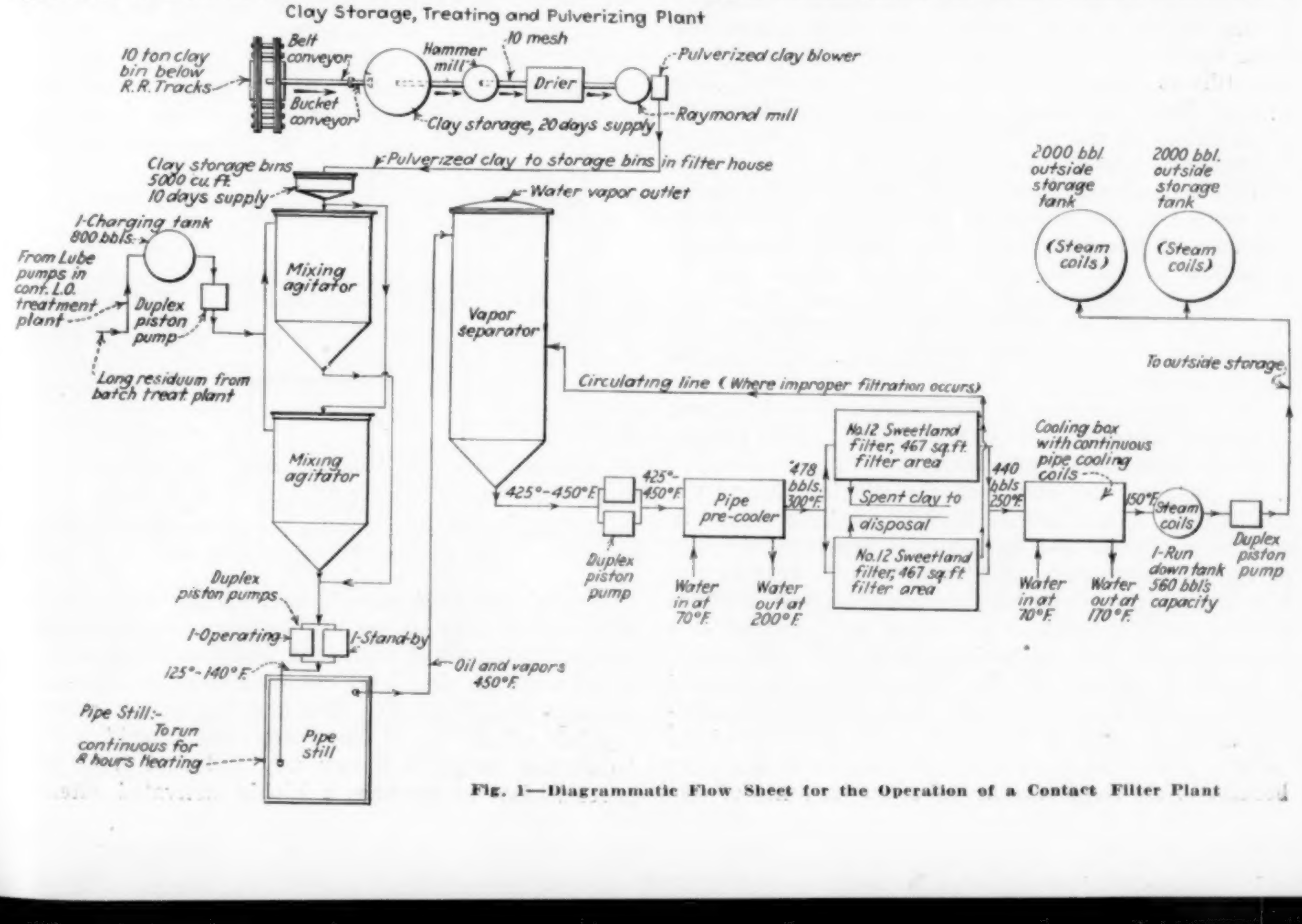


Fig. 1—Diagrammatic Flow Sheet for the Operation of a Contact Filter Plant

separated as overhead distillates, leaving a residue in the still that may be either a base for the manufacture of long residuum or of bright stock, depending upon the extent to which the crude has been reduced in the still; that is, depending upon whether or not the flash test is relatively high or low.

By this process of manufacturing lubricating oils, some refiners have made long residuums as low as 390 deg. to 400 deg. F. flash test and 60-65/210 deg. F. viscosity; and bright stocks as high as 540 deg. to 550 deg.

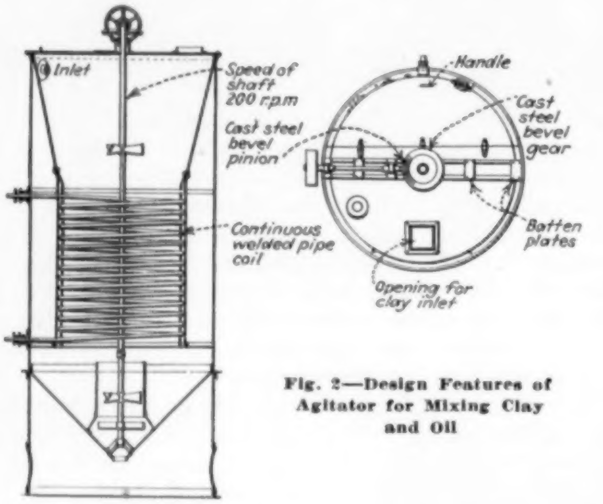


Fig. 2—Design Features of Agitator for Mixing Clay and Oil

F. flash test and 180-190/210 deg. F. viscosity. To date Producers and Refiners Corporation has specialized in the manufacture of a long residuum of 440 deg. to 450 deg. F. flash test and 80-85/210 deg. F. viscosity. For marketing reasons, however, it is very probable that eventually this lubricating plant will manufacture bright stocks exclusively. In either case, the crude itself is reduced in the still until the flash test on the residuum is such as will produce a finished lubricating oil stock having the desired physical characteristics.

The untreated long residuum or steam-refined cylinder stock, as the case may be, is then pumped from the stills to storage and thereafter, as required, it is pumped from storage to either one of two lubricating oil agitators in use at the Parco refinery. Here it is treated with sulphuric acid, using from 40 to 45 pounds of 66 deg. acid per barrel of oil, and after the sludge has settled to the bottom of the agitator, this sludge is drawn off into dump-cars. The treating temperature is as low as possible—from 140 deg. to 150 deg. F. Lower temperatures are impossible because of the high pour test of the residuum. Higher temperatures are detrimental to the treating process, as a darkening of the oil results.

The treated residuum is then contact filtered without any prior neutralization with an alkali. This process will be described in detail later.

As the next operating step consists in diluting the treated and filtered residuum with naphtha (prior to chilling the whole and subsequently removing the wax by centrifugal means), naphtha is used in washing the last traces of oil from the spent clay—these naphtha washings either being or not being, as is desired, discharged to the tank containing the filtered residuum.

Blending naphtha and the filtered oil are then mixed together until there is present in the mixture approximately 70 per cent of the former to 30 per cent of the latter. This high percentage of naphtha is necessary because of the large amount (25 to 30 per cent) of wax present in the residuum (from Lost Soldier or Salt Creek, Wyoming, crude oils) used at the Parco refinery in making lubricating oils.

The naphtha-oil blend is then chilled over a 24-hour period of time to plus 20 deg. F. and passed through Sharples centrifuges to remove a large percentage of the wax. The pour test of the oil before being dewaxed is about 115 deg. F.; after being once centrifuged, the reduced oil has a pour test of from 80 deg. to 85 deg. F., even though by this single dewaxing almost 85 per cent of the total amount of wax present in the original stock has been removed.

The partly-dewaxed oil is now chilled again over another 24-hr. period to approximately minus 15 deg. F., after which it is again centrifuged. The pour test on the reduced oil after having been twice centrifuged is 30 deg. F.

It is interesting to note that the Sharples plant built at the Parco refinery is the only one in the world wherein provision had to be made for a double centrifuging of the residuum to be dewaxed. This is because of the enormous amount of wax present in the crude oils from which lubricating oils are made at this refinery.

The dewaxed naphtha solution of the oil is pumped to storage, from which suction is taken by a pump at the lubricating oil reducing stills and the diluted stock subsequently reduced. When all of the naphtha has been removed, and a proper flash point has been obtained, the finished reduced stock is pumped to storage. Its physical characteristics will depend largely upon the point to which the original crude oil was reduced in the primary distillation.

The contact filter plant building proper is 50 ft. wide by 84 ft. long, and is 2-stories in height for five-twelfths of its length.

Fig. 1 is a diagrammatic flow sheet of the approximate manner in which the contact filtering plant at the Parco refinery is operated and the essential equipment

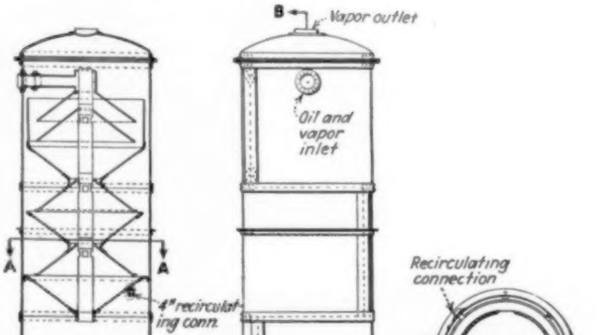


Fig. 3—Vapor Separator Into Which the Hot Oil and Clay Mixture Is Discharged from the Pipe Still

that is a component part thereof. A few discrepancies in operating data appear in this flow sheet, this being due to the fact that such data are theoretical as compared with the data later obtained in actual operating practice (see Table I). The sketches at the extreme top left of this chart are "proposed," should it ever be desired to grind a raw clay and acid treat such ground clay to produce a highly activated filtering

agent. To date, however, Florida or Georgia fullers earth of 100-mesh fineness has been used exclusively in filtering oils at the Parco refinery.

Two 7 ft. 6 in. x 17 ft. 9 in. steel mixing agitators are used in mixing together the oil and clay. (See Fig. 2.) In each agitator is a continuous welded steam pipe coil, made of 14 turns of 1½-in. standard steel pipe—the coil being 5 ft. in diameter.

The stirring devices in each mixing agitator are of the special cyclone type—each stirring device consisting of the following: 1. One 3-ft. shaft. 2. Five torpedo propellers. 3. One 24-in. diameter stirrer cylinder with necessary legs for support. 4. One step bearing. 5. One thrust bearing. 6. One bevel gear reduction and pulley for belt connecting to a 7½-hp., 1,200-r.p.m. motor.

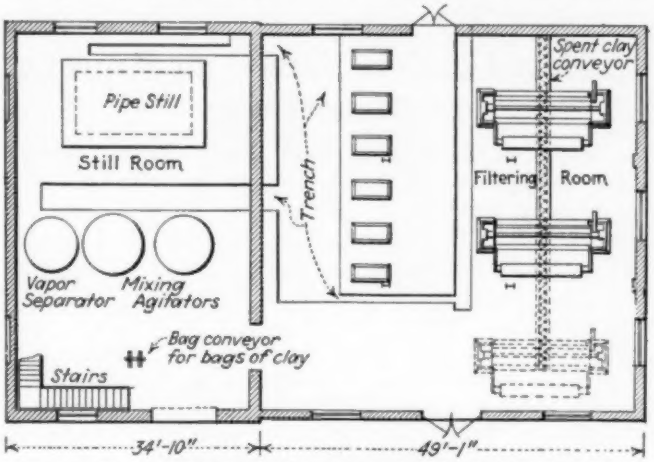
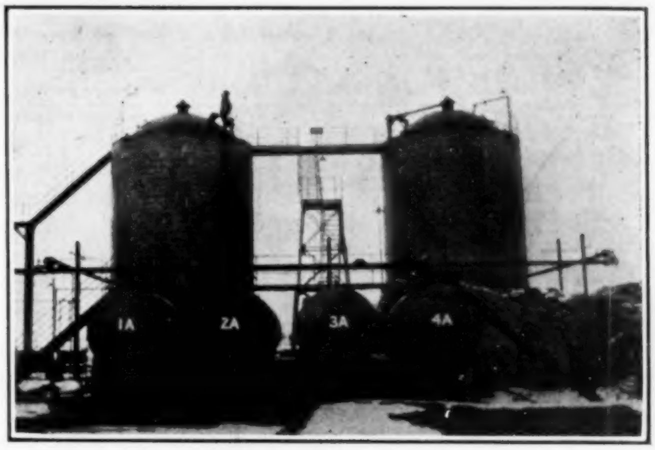


Fig. 4—Layout of Principal Equipment in Contact Filter Plant

The speed of the agitator shaft is 200 r.p.m. All gears are cut gears. Each agitator is further provided with suitable covers, one section of each cover being hinged. A 12-in. x 12-in. clay inlet bin fitted to each agitator makes it possible to dump in the clay with the covers closed.

A Foster pipe still is used to bring the clay-oil mixture to the necessary temperature. The steam coils in the agitator bring the oil to a temperature of about 180 deg. F., as at a much higher temperature there is danger of the whole boiling over, due to the agitation and foaming caused by the water being driven out of the clay. The Foster pipe still installed has a guaranteed rating of being capable of raising in eight hours the temperature of 20,000 gallons of 23 deg. A.P.I. gravity oil, mixed with 20 per cent of clay by weight—the clay in turn containing 20 per cent of water—from an entering temperature of 125 deg. F. to a final temperature of 450 deg. F.



Lubricating Oil Agitators at Parco Refinery

Fig. 3 shows the arrangement of the vapor separator into which the hot oil-clay mixture from the pipe still discharges. This is 6 ft. in diameter and slightly more than 20 ft. in height.

Suction is taken on the vapor separator by pumps and the clay-oil mixture is then pumped through two No. 12 Sweetland filters. These filters are 37 in. inside diameter by 145 in. long and each is equipped with 36 Monel metal cloth covered, bottom drainage type of interchangeable filter frames. These frames are evenly spaced, 4 in. from center to center. The internal manifold commonly used on Sweetland filters as a sluicing pipe is modified so that it can be used for circulating oil through the filter body, and then back to the agitator tank or heater. Arrangements are also made for passing naphtha through the filter after as much oil as possible has been blown out of the spent cake—this being done in order to keep oil losses at a minimum. A Braun condenser is also installed for reducing naphtha losses.

Before entering the filters, the oil-clay mixture passes through a series of cooling coils, thus materially reducing its temperature. When the filter is opened, the spent clay drops through a chute to a ribbon conveyor

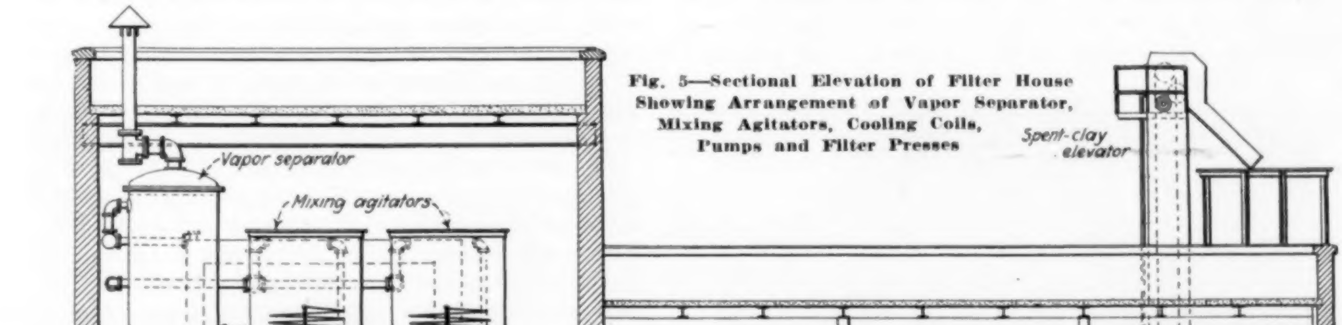


Fig. 5—Sectional Elevation of Filter House Showing Arrangement of Vapor Separator, Mixing Agitators, Cooling Coils, Pumps and Filter Presses

Table I—Operator's Report of Average Filter Pressing Cycle at Parco Contact Plant

Pre-Cooler Oil Temp. Deg. F.	Time Required for: Bldg. Cake Start	Bldg. Cake Finish	Filtering Start	Filtering Finish	Air Blow Start	Air Blow Finish	Washing Start	Washing Finish	Drying Start	Drying Finish	Cleaning Start	Cleaning Finish	Total (Min.)	Color Filtered Oil
300	7:42	7:49	7:49	7:57	7:57	8:00	8:00	8:07	8:07	8:18	8:18	8:24	42	7
300	8:31	8:38	8:38	8:48	8:48	8:51	8:51	8:58	8:58	9:07	9;07	9:10	39	7
290	9:10	9:16	9:16	9:28	9:28	9:31	9:31	9:36	9:36	9:45	9:45	9:48	38	6½
290	9:48	9:54	9:54	10:05	10:05	10:08	10:08	10:15	10:15	10:24	10:24	10:29	41	6
295	10:29	10:35	10:35	10:46	10:46	10:49	10:49	10:54	10:54	11:03	11:03	11:09	40	6
275	11:09	11:15	11:15	11:24	11:24	11:27	11:27	11:35	11:35	11:44	11:44	11:49	40	6
300	11:50	11:55	11:55	12:00	12:00	12:05	12:05	12:10	12:10	12:22	12:22	12:26	36	6
295	12:45	12:50	12:50	1:00	1:00	1:03	1:03	1:10	1:10	1:20	1:20	1:26	41	6
300	1:32	1:38	1:38	1:47	1:47	1:50	1:50	1:57	1:57	2:10	2:10	2:14	42	6
290	2:14	2:21	2:21	2:29	2:29	2:32	2:32	2:39	2:38	2:50	2:50	2:55	41	6
290	2:58	3:04	3:04	3:13	3:13	3:16	3:16	3:22	3:22	3:40	3:40	3:50	52	6

and thence is conveyed outdoors where a bucket elevator lifts it to a spent-clay hopper, from which the used clay is hauled away in dump cars.

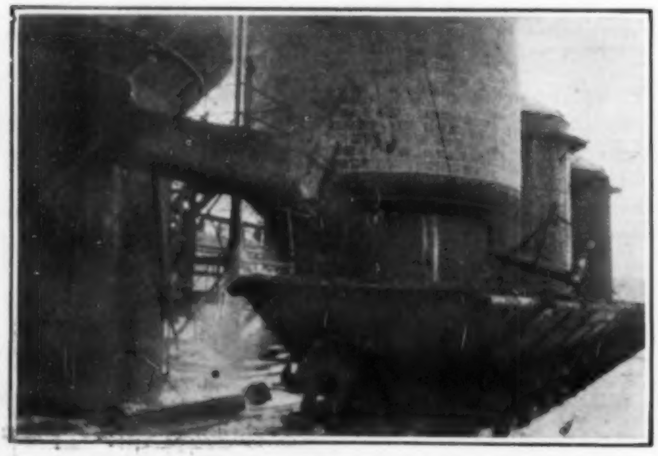
Other conveying equipment in the contact filter plant includes a bag elevator, which is used for lifting bags of fullers earth from the first to the second floor of the building, at which point the clay is dumped into the mixing agitators.

All of the pumps used in handling the clay-oil mixture in this plant are 7½x4½x10 Worthington horizontal, duplex, piston pattern pumps, having brass cylinder liners, steel piston rods, iron pump pistons, iron 3-ring packing, iron ball valves and with a piston rod stuffing box on the fluid end of sufficient depth to take six rings of packing each. The gaskets used on the fluid end also are of a special type with an asbestos base. These pumps are guaranteed to handle a maximum of 60 g.p.m. each of 23 deg. A.P.I. gravity oil containing 20 per cent by weight of clay at a temperature not to exceed 450 deg. F. This is based on a discharge pressure of 200 lb. and assuming that the steam pressure available will be 150 lb., 80 deg. superheat.

Other features of the construction, layout and the nature of the equipment used in the contact filter plant at Parco, Wyoming, are to be found in Figs. 4 and 5 and in the photographs that accompany this article.

Since the operating procedure is so simple—merely consisting in mixing clay with oil, agitating and heating, and then separating the spent earth by means of filter presses—more attention has been given in this article to the equipment used, and its nature, than to detailed operating data.

However, it might be mentioned that one-half pound of clay per gallon of oil is the amount of clay usually required at the Parco refinery to obtain a suitable color on long residuum. And for the interested reader, Table I gives operating data for the average cycle followed in the operation of the Sweetland filter presses.



Sludge Acid Discharge from Lubricating Oil Agitators

Must Develop Method for Re-using Contact Clay

Dr. E. R. Lederer of Fort Worth, Texas, presented a paper before the recent meeting in New York of the American Institue of Mining and Metallurgical Engineers on the "Production of Lubricating Oils Using Fine Clays." In a written discussion of this paper, Walter Miller, vice-president of the Marland Refining Co. of Ponca City, Okla., called attention to the lack of any practical method of recovering the finely ground fullers earth for re-use. This necessitates the discarding of the earth after one using, which is quite an expensive proceeding. This is not offset, he said, by the somewhat cheaper price of the average fine clay used for "dry" contact bleaching, and is accentuated in the case of the very expensive acid-treated types. Incidentally, the increasing use of the multiple muffle hearth furnace for burning and regenerating the coarse fullers earth is materially decreasing the cost of percolation filtering. This has increased greatly the number of times which coarse fullers earth can be reused, as pointed out by H. W. Camp, general superintendent of the Empire Refineries. (See *Chem. & Met.*, August, 1926, pages 472 and 473.) Mr. Camp presented a paper on this subject before the meeting of the Western Petroleum Refiners Association held at Wichita Falls, Texas, during January of this year.

An Engineering and Equipment Problem

"I feel quite optimistic," Mr. Miller said, "about the possibility of ultimately recovering the fine fullers earth. It is to a very large extent an engineering and equipment problem. It may be that the number of times which we will ultimately re-use fine clay is considerably less than is now possible with the coarser material, but even a few extra usings without too great a loss in efficiency would effect a great economy in operating costs. Some laboratory scale work carried out by reburning the fine clay in an electric furnace at from 750 to 1,000 deg. F. indicated possibilities of efficiencies on used earths of from 75 to 85 per cent of the original efficiency after the first high-temperature regeneration, with additional losses of 10 to 15 per cent after each subsequent reburning. Undoubtedly a special type of furnace will have to be developed or adapted for this, and means provided for preventing high losses of the very fine particles. In order to make re-using practical, methods also will be required for more fully recovering the good oil retained by the clay, or the naphtha or other solvent used for washing out the oil, which at the present time is also an operating handicap of many contact plants. I think that all who have had experience with contacting to date will agree with Dr. Lederer that in the next 2 or 3 years we will go a long way in the progress and development of this art."

Waste Sulphite Liquor as an Agricultural Spray

Recent studies suggest wide application of this paper-mill waste as a fungicide and insecticide

By C. S. Fleming and J. H. Reedy
Department of Chemistry, University of Illinois

THE utilization of the "blow-pit" liquor from paper mills using the sulphite process is one of the most urgent, but discouraging problems of industrial chemistry. Various uses have been suggested, as the manufacture of ethyl alcohol, adhesives and fodder for stock, but none of these appear to be commercially feasible in this country. The conversion of sulphite liquor into agricultural spray materials is a possibility that does not seem to have been suggested.

Sulphite waste liquor contains sulphur dioxide mainly as calcium bisulphite, along with a smaller amount in the free state, to the extent of 0.2 to 0.7 per cent. These should react with hydrogen sulphide giving a precipitate of sulphur according to the equations:

$$Ca(HSO_3)_2 + 5H_2S \rightarrow CaS + 6S + 6H_2O;$$
$$SO_2 + 2H_2S \rightarrow 3S + 2H_2O.$$

The product approximates in composition the lime-sulphur spray material used extensively as a fungicide and insecticide, the efficiency of which is recognized generally. Through the co-operation of the Flambeau Paper Co., Park Falls, Wis., this problem has been studied at the University of Illinois.

Upon saturation with hydrogen sulphide, the sulphite liquor changes from deep brown to chocolate, due to the separation of free sulphur. The liquor contains from 7 to 9 per cent of organic matter, principally of a sugar-like substance, and this peptizes the sulphur so that it will remain in suspension several hours without "flocking out." The permanence of the suspension may be enormously improved by the addition of 0.5 per cent of gelatine or corn sugar, when the suspension may persist for days. After sedimentation has occurred, agitation will restore it practically to its suspensoid form. Moderate temperatures (60 deg. to 95 deg. C.) were found to be most suitable for the preparation of these suspensions.

The reduction of calcium bisulphite with hydrogen sulphide is so slow that several hours are required for its completion. Close examination indicates that it probably proceeds in steps as follows:

$$Ca(HSO_3)_2 + 5H_2S \rightleftarrows CaS + 6S\ \text{(soluble)} + 6H_2O;$$
$$6S\ \text{(soluble)} \xrightarrow{\text{slow}} 6S\ \text{(precipitate)}.$$

The postulation of an intermediate form of sulphur which is soluble and which opposes the first of these reactions, is based upon several considerations. Upon treating sulphite liquor with hydrogen sulphide, the suspended particles in the liquor show the Brownian movement in a remarkable degree. This movement is presumably due to the bombardment of these particles by sulphur particles of sub-microscopic dimensions. As the reaction mixture stands, this Brownian movement gradually subsides and particles of sulphur appear. Upon resaturation, this behavior repeats itself, with the subsequent formation of a second sulphur precipitate. It is a well-known fact that when a thiosulphate is acidified, the sulphur does not precipitate instantly, although the decomposition of thiosulphuric acid is known to be rapid.

Sulphite liquor treated in this way has been tried out on a small scale as a spray material with favorable results. Numerically the results were not concordant, and no definite statement as to the effectiveness of the material can be made until the spray has been used in the field. However, it seems safe to say that its effectiveness is several times that of the usual run of sulphur sprays, doubtless due to the small size of the sulphur particles. The organic content of the liquor is valuable in preventing the flocculation of the sulphur particles, in increasing the adhesiveness to the foliage of the plant, and in retarding evaporation.

Alcohol a Possible Byproduct

The sulphuretted liquor contains only a small amount (0.5 to 1.0 per cent) of active sulphur. Transportation charges on the large proportion of inert water would increase the cost to the consumer considerably, and a method of concentration is highly desirable. It was found that by omitting peptizing agents and adding a small quantity of hydrochloric acid or other strong electrolyte, the sulphur can be precipitated, and separated by filter-pressing as a brown, gummy solid. This product is readily wetted and may be easily resuspended in water, giving a milky mixture that does not settle for hours. The filtrate from the sulphur precipitate contains most of the fermentable materials and may be utilized in making alcohol.

Bibliography of Rubber Technology

A bibliography of rubber technology has been prepared by the Rubber Committee of the Special Libraries Association. The seven sections cover developments during the years 1924, 1925 and the first half of 1926.

Section 1. Latex and Raw Rubber. (In progress.)
Compiled by Elizabeth Wray.
Librarian, United States Rubber Company.

Section 2. Compounding Ingredients, including Organic Accelerators.
Compiled by Edith L. Shearer.
Librarian, Western Union Telegraph Company.

Section 3. Physics of Rubber, including Physical and Mechanical Testing.
Compiled by Edith L. Shearer.
Librarian, Western Union Telegraph Company.

Section 4. Chemistry of Rubber, including Chemical Analysis.
Compiled by Edith L. Shearer.
Librarian, Western Union Telegraph Company.

Section 5. Manufacturing Methods and Devices. (In progress.)
Compiled by Josephine A. Cushman.
Librarian, Bierce Library, Municipal University of Akron.

Section 6. Synthetic Rubber and Rubber Substitutes.
Compiled by Julian F. Smith.
Technical Librarian, The B. F. Goodrich Co.

Section 7. Reclaiming Rubber.
Compiled by Rose L. Vormelker.
Librarian, White Motor Company.

The complete set costs $3, and separate sections cost 50 cents each. Orders should be addressed to Edith L. Shearer, Room 2208, 195 Broadway, New York, N. Y.

Patent Literature as a Source of Information

Description of official publications of various countries, compilations, indexes and special library facilities

By Julian F. Smith

Technical Librarian, The B. F. Goodrich Co., Akron, Ohio

FROM the searcher's viewpoint, the value of technical literature, including patents, lies in the fundamental truth that human progress rests on the foundation of the past. Our courts have aptly considered the grant of patent rights to be a contract in which the inventor receives certain protection from the Government, and in return discloses to the public the new and useful information embodied in his invention. In the very nature of such an arrangement, much scientific and technical knowledge is thus made public which otherwise would be kept secret.

He who sets out to explore a new field of knowledge should choose as an important part, if not the first part, of his program an examination of past records. Often a preliminary search will show that the proposed exploration has already been made. Then the expensive labor of going over the same ground again is saved. In any case the investigator learns, by a properly conducted search, where his predecessors left off and where he actually enters new territory.

The total number of patents issued in the world up to this time runs well into the millions. Our own country has granted considerably more than a million and a half and is increasing the number by something like 35,000 per year. Viewed in that light, it is easy to see why patent literature contains a great mass of scientific and technical information not to be found elsewhere.

If every patent represented a separate invention, the output would be amazing; but there is much duplication. In some countries (notably France) the patent office makes no examination to ascertain if an idea is new; hence the same invention may be patented more than once. But there is a much greater cause of duplication in the fact that valuable inventions are generally patented in several or many countries. Even allowing for duplication, the number of patents may still seem remarkable unless it is remembered that thirteen nations issue printed specifications, and that slightly more than a hundred others grant patents but do not print them. (Miles O. Price, Librarian of the Patent Office, states that this number should now be fifteen, because Italy has lately begun to issue printed specifications, and Russia has resumed the custom after a lapse of some years.)

Official Government Patent Literature

The thirteen nations include the United States, Japan, two British colonies (Australia and India) and nine nations of Europe. All of them but Sweden publish also an official journal giving essential data (in some cases with abridgments) of patent grants and applications. The more important of these are the *Official Gazette* (United States), the *Illustrated Official Journal* (Great Britain), the *Patentblatt* (Germany), the *Oesterreichische Patentblatt* (Austria), the *Patentliste* (Switzerland) and the *Bulletin Officiel* (France).

Official journals are also issued by many of the patent offices which do not print their specifications. Notable examples are Canada, Italy, Belgium, Spain, some British colonies and the larger Latin-American nations.

In some official journals abridgments of specifications are given, arranged in numerical order (as in the United States, Canada, England) or in classified order (as in Germany and Austria). Others (e.g. in France) give only essential data (number, date, patentee, title, etc.) without any abridgments. Those countries which allow public inspection of pending applications publish essential data of applications as well as of patents already granted.

Patent Office Searching Facilities

For searching purposes, the most important patents are those of the United States, Great Britain, Germany and France. Switzerland and Austria come next. Dutch, Scandinavian, British colonial and Japanese printed specifications are less important but not to be forgotten. They are given a minor rating for two reasons: first, they are not numerous, and second, many of them are duplications from the larger countries. The common practice of patenting valuable inventions in many countries is responsible for much duplication.

To the searcher, the one vital feature of patent publications is the manner in which they are classified or indexed. The U. S. Patent Office has an elaborate classification which is constantly being revised. It is essentially a functional classification; that is, first consideration is given to the function performed by a device and not to its structural, physical or chemical features. The classification of a given patent is based solely on the claims; but there is a system of copious cross references to guide the searchers to like patents in other classes and to matter appearing in specifications but not in claims.

Searchers in the U. S. Patent Office have access to files of printed specifications arranged according to this classification. The Annual Report of the Commissioner of Patents includes an index of patentees and assignees, and a title index in which entries are made from the leading word of the patent title. As a subject index, this is worth hardly anything. Therefore, as far as Patent Office publications are concerned, the searcher must rely on classification. This has its advantages, and searching is greatly facilitated by the cross references; but there is the inherent disadvantage of all classifications in the fact that many patents are capable of being classified in more than one way. This compels the searcher to go through all the sub-classes in which his topic might appear.

The British classification is much simpler. It also is largely functional but does not adhere strictly to that idea. To search British patents solely by classes would be comparatively tedious; but the Office has been diligent in providing other searching aids. These include the *Subject Matter Index*, going back to 1617; the numbers prior to 1884 are mostly out of print and can be consulted only in libraries. Then there is the "Fifty Years Subject Index," from 1861 to 1910, in 271 parts for the 271 sub-classes. These may be had at 6d. each. From 1911 on there are annual subject indexes, not classified; and in each current year quarterly subject indexes are issued. An additional searching aid is the series of "Illustrated Abridgments of Specifications." For each of nine periods from 1855 to 1908, these occupy 146 volumes correponding to the 146 divisions of the

old classification. The revised classification is in 271 parts, so there are 271 volumes after 1908. The period 1909-15 is complete; the periods 1916-20 and 1921-25 are still in course of publication. Classified abridgments are easier to search than complete specifications; but the limitations imposed by the necessary omission of detail must be duly considered.

The German classification is somewhat more elaborate than the British, but much simpler than the American. It has been adopted by several patent offices in the smaller countries. A translation appeared some years ago as a U. S. Government document; and the British Patent Office has published a "Key to the Classifications of the Patent Specifications of France, Germany, Austria, Netherlands, Norway, Denmark, Sweden and Switzerland."

In reviewing official journals (such as the U. S. *Official Gazette*) to find patents of probable interest, the reviewer must keep in mind the universal desire of inventors to get as much protection as possible. This desire gives rise to the custom of couching patents in general terms, in order to cover all the ground the Patent Office will allow. Thus, a jointed doll becomes an articulated toy; a vacuum tube is an electron discharge device; a child's scooter is a two-wheeled vehicle, etc. By reasons of this custom, the specific purpose of a patent is often totally concealed in the title, and may be difficult or impossible to find in the abridgment. Sometimes the illustration tells the secret; or there may be a clue in the name and business of the assignee, or even in the inventor's address. Thus, a patent from Detroit is likely to have an automotive slant; and one from Akron is almost sure to have some relation to rubber, oatmeal or fishing tackle. When the official journal gives no clue, it becomes necessary to refer to the printed specification and drawings to ascertain the specific nature of the invention.

Guides to the Patent Literature

For some special fields of invention there are unpublished unofficial guides which supplement the functions of the official publications. Chemical technology is particularly well equipped in this respect. In the field of mechanical inventions, on the other hand, the main reliance must be placed on searching the classified specifications (or the indexed abridgments) themselves. As pointed out by a former patent examiner, this difference is a natural consequence of the inherent difficulty of searching chemical patents which, unlike mechanical inventions, cannot be illustrated by drawings.

One of the principal aids to chemical searching is to be found in the U. S. Patent Office. This is the chemical card index, started in 1899 by Dr. A. E. Hill of the corps of examiners. It contains over a million cards, from patents and the general literature of chemistry, divided into a subject index and a formula index. Unfortunately it was discontinued in 1919.

There is also the card index of E. C. Worden, a consulting chemist of Milburn, N. J. This index was described by Payne in *Chem. & Met.*, Jan. 5, 1925, p. 17. It has about two million cards, showing all the occurrences of every chemical substance mentioned in United States patents from 1900 to date.

Chemical patents of the world are well covered by *Chemical Abstracts*, and indexed (in annual and decennial indexes) by patentees' names and by subjects. Number indexes are an additional feature in *British Chemical Abstracts* and in the *Chemisches Centralblatt*. German chemical patents, from the beginning of the German Patent Office in 1877, are treated in three large special compilations, and are indexed by numbers, patentees and subjects in the annual collective indexes of some of the German chemical periodicals. The best of the number indexes was published about a year ago. It lists, by number only, all the German patents mentioned in *Wagners Jahresbericht der chemischen Technologie* from 1878 to 1924.

Special Compilations on Chemistry

The largest of the three special compilations is by Friedlaender, on coal tar and its derivatives. It gives the complete text of all German patents, with cross references to foreign patents, on dyes, medicines and other chemicals made from coal tar. Each classified group has an introduction by the compiler. The patents are indexed by subjects, patentees and numbers, with a collective numerical index of preceding volumes in each of the later volumes. Volume 14 was issued recently.

German patents in inorganic chemistry are similarly treated by Brauer and D'Ans. Of this work, three volumes have been published and more are to follow. Organic chemical patents were collected by Winther for the period of 1877 to 1906, in a work comprising two volumes of text and one volume of indexes. No later volumes of Winther's compilation have been issued. Mechanical inventions also receive some attention in German publications, chiefly in *Dinglers polytechnisches Journal* (1820 to date) and *Repertorium der technischen Journal-Literatur* (1823 to 1907). The latter was supported, from 1877 to 1907, by the German Patent Office.

Reviews of the patent literature on many special topics may be found in books and periodicals. Some of them are comprehensive. Ellis, "Synthetic Resins and Their Plastics," Hemming, "Plastics and Molded Insulation," and Bedford and Winkelmann, "Systematic Survey of Rubber Chemistry" are good examples.

Facilities of Patent Office and Special Libraries

The searcher who can go to the Patent Office has every advantage. The large and comprehensive library of the Patent Office provides the necessary technical literature and works of reference; complete classified files of United States Patents are available; and there is a nearly complete collection of the printed specifications and official publications of all the patent offices of the world. The chemical card index has already been mentioned. Experienced translators are at hand, to iron out difficulties with foreign patents, even in the uncommon and lesser known languages. And last but not least, the searcher has at his service one of the leading technical libraries of America. When a desired reference is not to be found in the Patent Office, it can generally be located in one of the numerous scientific and technical libraries of Government departments and bureaus in Washington.

Excepting for the classified files of United States Patents, searching facilities are nearly as good in and around New York City. The New York Public Library has the printed specifications of several countries, and official journals of several more. It also has a splendid reference library; and so have the Chemists Club and the Engineering Societies. Worden's chemical card index, previously mentioned, is not far from New York City.

Smaller patent collections may be found in the public

libraries of most large cities, in some of the state libraries and the larger universities, and in certain institutional libraries. Notable among these are the collections of the Franklin Institute in Philadelphia and of the State Historical Society in Madison, Wis. In St. Louis, the Mercantile Library has some items not to be found in the city's public library. For searches in which the required degree of thoroughness demands actual examination of the classified files, the services of professional searchers in Washington are always available.

In conclusion, let it be said again that patents form a vital part of the literature of technology, and are not to be neglected when the previous knowledge in a given subject is to be ascertained. The purpose of this paper has been to emphasize this point and to give some indication of the kind and amount of patent literature available for consultation.

An Outline for Industrial Research

Systematic investigation of raw materials, processes and products essential to sustained production economy

By Hugo V. Hansen

THE principles underlying most of the major functions of industrial research such as making investigations and developing processes have been discussed often enough to be well established. To be most effective, they should be combined into a crystallized working program. The plan has, as its central idea, that of first determining wherein the finished product needs standardization. The process and the raw materials are then standardized with respect to the product. Upon this foundation of a logically standardized process, technical improvements and pioneer developments can be safely erected. The various steps to be taken to attain this end, may be developed in more detail as follows:

(1) *Determine the physical and chemical properties of the finished product and the limits within which they vary. Record the tests by which these properties are determined and the precision of these tests.* It is believed that there are relatively few concerns which have this information in readily available and comprehensive form. Much of what is accepted as true about the product may be based upon obsolete data or upon tradition. This investigation will be primarily a laboratory and literature one. It is not the purpose to go into the technique of this type of investigation but merely to indicate how it may be conducted most effectively.

The viewpoint should be comprehensive and varied so that no tests or properties will be overlooked which might bear, even remotely, on the actual or possible uses of the product. The cost or selling price per unit may be regarded as one of the properties of the product in this connection and in all other steps of this program. If the product has an appeal to the senses, data bearing upon this point may be included. Extreme accuracy of individual tests is not required; approximations may be just as useful, provided the degree of approximation is known. Greater precision can always be developed after the need for it is shown.

The investigation may develop results of more or less commercial value from the start. If the product is shown to fluctuate widely in some properties, control tests may be instituted, leading eventually to greater uniformity. As new and authentic facts about the product are uncovered they may be of assistance to the sales department or the management. The increasing practice of featuring laboratory tests in advertising is an illustration to the point.

(2) *Determine the relationship between the properties of the product and its uses. Select or develop laboratory tests which will predict the performance of the product in use.* As an industry becomes more competitive, consumer requirements tend to become more strict. It is held to be more economical to anticipate consumer requirements by the aid of carefully compiled data and tests than to wait until complaints make action imperative.

(3) *Compare the product with that of competitors in all its significant properties and under all service conditions.* The results of this investigation will orient the concern technically with respect to the rest of the industry and will furnish the management with important facts. Such a comparison can hardly be conclusive in the absence of authentic data and such tests should be developed in the first two steps of this program. Conclusions as to comparative quality, favorable or unfavorable, must be based on indisputable evidence, readily demonstrable.

Guided by the data obtained in the preceding steps, a logical and attainable specification can be drawn up, picturing the ideal product, in contrast with the more or less faulty product being currently manufactured. Such a specification should have the same effect on a research staff as the assignment of quotas has upon an alert selling organization, especially if similar material incentives are offered for the attainment of the various objectives.

It will be noted that the foregoing steps of the program deal entirely with the finished product, its properties and uses. Theoretically, these steps can be carried out without reference to or knowledge of the process by which the product is made. These properties and uses of the product are of course the sole reason for the existence of the process. Therefore, their thorough investigation and study should logically take precedence of and give direction to the further development of manufacturing technique.

(4) *Study the successive steps of the manufacturing process. Determine if all steps are conducted according to a definite written procedure and how much personal equation is present in each step.* This investigation involves of course, its own technical problems, not the least of which is the maintenance of a spirit of co-operation between the research and production forces. Control tests of intermediate products will help to effect more uniformity of product.

(5) *Make a study of raw materials and develop specifications and tests which will insure a uniform supply.* All that is aimed at in this step is to insure a uniform supply of raw materials. Control tests need not be of extreme precision; merely enough to detect marked variations. Possible alternative raw materials may also be investigated at this stage.

(6) *Study the preceding data in order to correlate information on the product with that on the process and materials. From such study determine needed improvements in the process and materials.* The improvements which are urgently needed to insure the commercial progress of a company may not necessarily be the most

obvious ones. It is felt to be a matter of common experience that process or material changes which on the surface offer decided advantages may develop unexpected shortcomings. On the other hand, sound and necessary improvements may be held up indefinitely because of accompanying difficulties which appear to be fundamental but which are in reality superficial. Such changes therefore cannot be safely based upon snap judgment or upon data of limited application. The element of risk inherent in these changes can best be reduced to a minimum by basing them upon the careful study and correlation of all known and significant facts about the product and process.

In the study of such accumulated facts the need may be brought out for more complete data in connection with certain processes. The gathering of these data may constitute the objective of more specialized investigations into processes. It is felt that such investigations gain in effectiveness if made as a logical step in a comprehensive plan instead of as more or less isolated and independent projects.

(7) *Study the trend of invention as it will affect the future type of product made and as to whether it will tend to narrow or broaden the future market for the product.* New products or processes are patented from time to time which seem destined to offer formidable competition in the future. Many of them, however, soon drop out of sight. To evaluate properly the effect of such discoveries on a given industry, a comprehensive and detailed knowledge of that industry is indispensable. It is felt that only a concern which has acquired such a knowledge by successfully following a program of standardization and improvement such as has been suggested is in a position to safely enter the field of pioneer research with its chances of costly litigation.

In this paper an effort has been made to outline a broad program which in its essentials should apply to any manufacturing concern. It is of course recognized that the outcome of any industrial research program hinges on many factors that have not been discussed, such as organization and supervision.

Sulphur as a Heating Medium

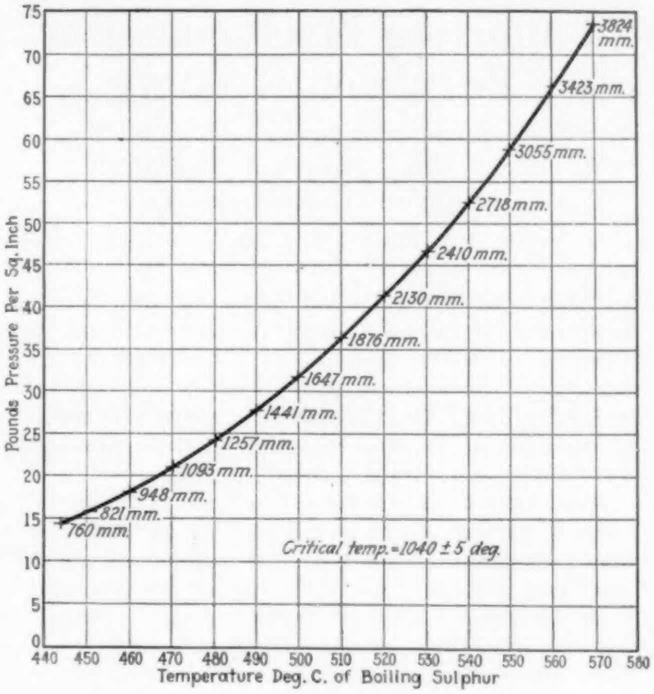
By William H. Kobbé

New York City

MELTED sulphur possesses many advantages over other materials as a heating medium. It is not subject to chemical change under the action of heat and covers a wide range of temperature between its melting and boiling points. It is inexpensive, non-toxic and not subject to material loss through vaporization. In its melted state it is not nearly as corrosive to steel and iron as is commonly supposed and is readily handled in contact with these metals.

Sulphur melts at approximately 120 deg. C. (248 deg. F.) and boils at 444.6 deg. C. (832 deg. F.). Its flash point is about 250 deg. C. (482 deg. F.) when in contact with air but in a covered receptacle may be heated up to its boiling point.

From the foregoing figures it appears that practically any temperature between the melting point and the boiling point, or over a range of 324.6 deg. may be maintained in an ordinary double boiler or jacketed container without the use of pressure. Convection currents are active in molten sulphur except in its viscous stage extending from about 160 deg. C. (320 deg. F.) to 250 deg. C. (482 deg. F.). It is therefore possible to use direct heat to the sulphur which transfers it uniformly to the inner container and its contents. This is preferably done with gas or oil although coke or other readily controlled combustion materials may be used.



Vapor Pressures of Liquid Sulphur

Sulphur is particularly advantageous under a range of temperatures which crack and decompose the oils or other heating mediums and by applying comparatively low pressures to boiling sulphur a wide range of temperatures above its boiling point is obtainable. This is indicated by the vapor pressure curve for temperatures from its boiling point to 570 deg. C. (1,058 deg. F.) with pressures ranging from 15 lb. to 75 lb.

Cast iron, aluminum and chromium steel are practically unaffected by molten or boiling sulphur, and ordinary black iron or sheet steel is only slightly acted upon and for all practical purposes may be employed in installations where it seems advisable to use sulphur as a heating medium in a double boiler or other appropriate apparatus.

Master Specification Issued for Safety Matches

In connection with the standardization of supplies used by the Government, a technical committee of the Federal Specifications Board has prepared, in co-operation with the manufacturers, a master specification for the use of the various branches of the Government in the purchase of safety matches, full size, in boxes. The specification was officially promulgated by the Federal Specifications Board on September 25, 1926. The requirements cover the performance of the splints, heads and box coatings. Methods of inspection and testing, and details as to packing and marking are included. The specification is published as Circular No. 318 of the Bureau of Standards.

Copies may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 5 cents each.

Improving Fractionation in Petroleum Refining

Basic principles developed in alcohol distillation can find profitable application in oil industry

By D. B. Keyes
University of Illinois, Urbana, Ill.

IT IS ONLY within recent years that the petroleum industry has begun to apply the basic scientific principles of fractional distillation to the manufacture of motor fuel and lubricating oils. Even today there are seemingly many small companies in which there is no appreciation of the economic value of the application of these simple underlying scientific facts.

This attitude in some cases can be justified. Competition has not always been keen. Gross profits rather than percentage profits were the paramount objective. The time necessary for an adequate development of scientific ideas would have been long and ultimate success not absolutely certain. It seemed better business to invest in a well known and standard process, crude

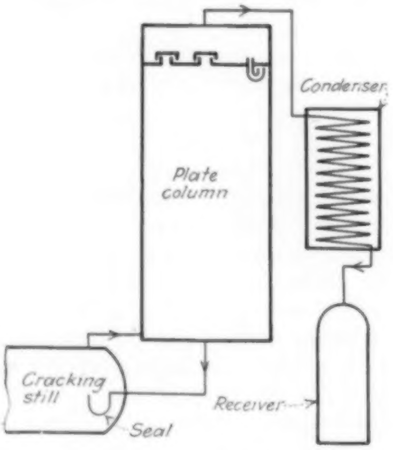


Fig. 1—Fractionating Column Without Reflux

though it was, and be assured of reasonable success than to gamble in a long and costly development with a goal representing only a possible 10 per cent increase in profits. It should also be remembered that applied physical chemistry has only recently come into its own.

In the fractionation of petroleum distillates it has not been found necessary to use any new applications of physical laws, because fractionation has long been utilized in a highly developed form in the alcohol industry. It has only been necessary to recognize the basic principles of this operation and to modify the equipment to meet the special requirements of the petroleum industry. In passing, it should be noted that this transposition of an operation with slight modification from one industry to another constitutes the basis of many of the great industrial developments and often "rises to the distinction of an invention."

In order to give a simple illustration of what could be done, and probably is being done in some of the more modern refineries, the writer has selected two popular fractionation processes used to separate motor fuel distillate from the gaseous products of a liquid phase, pressure cracking process.

Fig. 1 is a diagrammatic sketch showing a bell cap fractionating column connected to a pressure still by a vapor line and a liquid return. It will be noted that no reflux is used in spite of the fact that this is a fundamental feature of all rectifying columns used elsewhere and necessary for proper fractionation. (The use of a reflux condenser was fully described by John French in 1651 in his book on distillation.) The vapor feed serves as the heating medium and enters at the bottom of the column thus saturating the liquid flowing down with valuable product. This scrubbing liquid

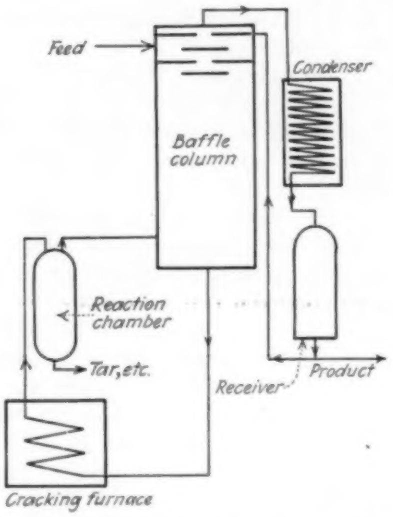
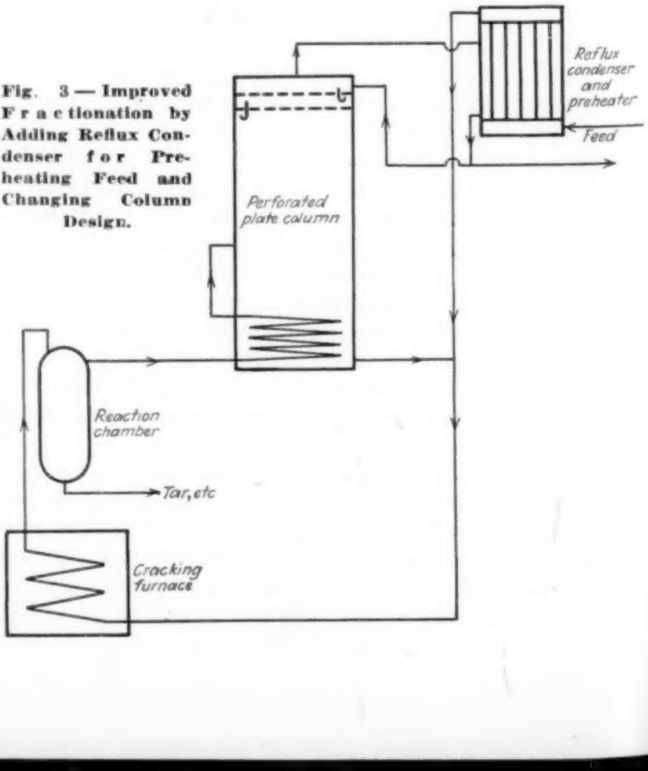


Fig. 2—Introducing Reflux and Reaction Chamber But With Improper Type of Column

is evidently produced by condensation on the walls of the column and carries the valuable product back to the cracking still where it is liable to be cracked further into non-condensable gas.

Fig. 2 is a sketch of another fractionation process for the same purpose. Here a part of the final product is used as a reflux in the column—an improvement based on sound physical principles—but the type of plate used in the column is contrary to good practice and should show a low efficiency. The feed to the cracking tubes is preheated by the simple expedient of allowing the vapors in the column to come into contact with this liquid as it flows down. It can, of course, be argued that the heat transfer is excellent but it must be as-

Fig. 3 — Improved Fractionation by Adding Reflux Condenser for Preheating Feed and Changing Column Design.



sumed that such an operation seriously interferes with the fractionation. Again, the vapor feed enters the bottom of the column and comes into contact with the liquid leaving for the cracking tubes. It is estimated that about 12 per cent of the final product is carried back to the cracking tubes by this arrangement. It will be noticed that this process includes a reaction chamber for the separation of tars, coke, etc., from the products of the cracking tubes.

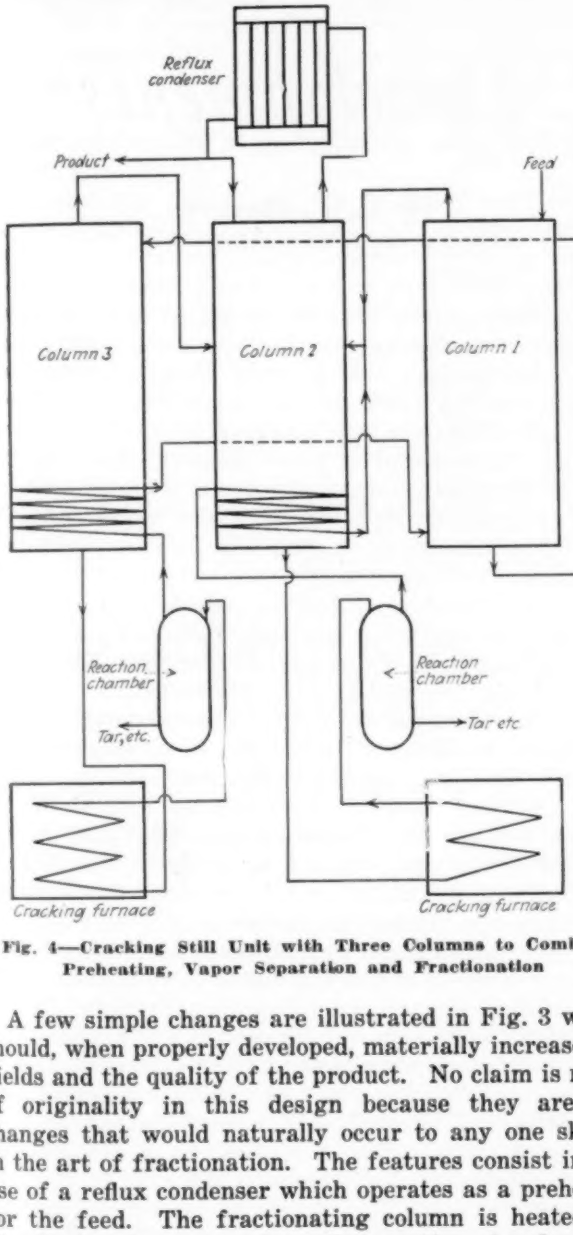


Fig. 4—Cracking Still Unit with Three Columns to Combine Preheating, Vapor Separation and Fractionation

A few simple changes are illustrated in Fig. 3 which should, when properly developed, materially increase the yields and the quality of the product. No claim is made of originality in this design because they are the changes that would naturally occur to any one skilled in the art of fractionation. The features consist in the use of a reflux condenser which operates as a preheater for the feed. The fractionating column is heated indirectly by the vapors from the reaction chamber and the feed, consisting of both vapor and liquid, enters the column several plates up from the bottom, thus permitting the removal of most of the valuable product from the residue before it is returned with the heated feed to the cracking furnace. This should overcome some of the defects of the last mentioned process.

Fig. 4 shows a more elaborate method of fractionation and cracking. Three columns are used in order to separate the three operations. The column on the extreme right is used to preheat the feed by direct contact with the hot vapors, an efficient process. The column on the extreme left is used to extract any dissolved product from the preheated feed; this column is therefore indirectly heated. The central column is used for fractionation to remove the product and is indirectly heated. The furnace on the left is charged with the preheated feed which comes out of the column on the left. This furnace supplies hot vapors to a reaction chamber where tar, etc., are removed and then the vapors indirectly heat the left hand column and directly heat the cold feed in the right hand column. The right hand furnace receives its feed from the central column and therefore operates under different conditions than the other furnace. The vapor product has the tar and coke removed from it in a separate reaction chamber and then passes on in order to heat indirectly the middle column and finally to enter as feed into this same column. The right hand column utilizes the cold feed as a reflux and the vapors from this column enter as feed into the middle column. The residue, or preheated feed, from the right hand column is used as the reflux in the left hand column. The vapors from this last mentioned column enter as feed into the middle column.[1] A regulation reflux is used on the middle column. It would be well to run the columns under a moderate rather than high pressure.

Although this design may seem a little complicated there has been no departure from standard fractionation practice and no unnecessary steps have been added. It should be realized, however, that we are not dealing with a simple binary or ternary mixture and therefore considerable experimentation will be necessary before this method is made practical.

In this connection it has been noted that there is a tendency when fractionating a cracked petroleum distillate, for certain gummy bodies to form upon the plates, presumably from unsaturated compounds produced during cracking. The bell cap fractionating plate has proved efficient because it holds bodies of oil at a definite temperature for appreciable lengths of time giving a chance for these gums to form. It would therefore seem expedient to alternate with regulation storage plates such as that indicated in Fig. 5. This type of plate would give any desired depth of liquid and any desired space for the deposition of the gums and at the same time would be simple to clean. There is also shown in this sketch a cone type of fractionation plate that might prove satisfactory for this particular class of work. The ordinary sieve plate with a "J" down pipe might prove efficient provided the column was heated by a steady flow of heat, a condition that might not occur when the column was heated directly by the vapors from a cracking unit but might occur if heated indirectly by vapors from the same source.

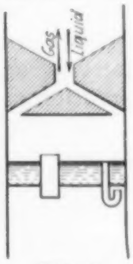


Fig. 5

In conclusion it should be reiterated that these modifications of existing practice are not finished processes but are merely examples of how a few well known fundamental principles might be applied to present day petroleum fractionation with the promise of more satisfactory results.

The writer also wishes to acknowledge the able assistance of F. C. Howard in the preparation of this article.

[1]For the sake of simplicity all three feeds to the central column are shown as entering on the same plate. In practice, however, each would probably enter on a separate plate as the composition of each feed will differ somewhat from the others. The position of each feed, after the first has been located, will be fixed by the composition of the liquid on the feed plate. The two compositions should be as nearly alike as possible.

Wood Pulp Products of WISCONSIN *Promise Future Chemical Developments*

By C. F. Burgess
C. F. Burgess Laboratories, Madison, Wis.

Wisconsin has 2.47 per cent of the total population of the U.S. Wisconsin produces 2.84 per cent of the manufactured products But Wisconsin produces only 0.3 per cent of the chemicals of the U.S. Wisconsin's principal raw material is wood cellulose

WISCONSIN has thus far been a minor contributor to the chemical products of the country. Its position among the leading industrial states was attained by reason of its marvelous forest resources together with the quality of its population, which in a large measure, was derived from the agricultural and industrial districts of northern Europe. With the rapid harvesting and depletion of the forest crop has come addition and diversification of industry.

This state with 2.47 per cent of the total population of the nation has, according to the 1923 Census of Manufactures, 3.99 per cent of the listed industrial establishments and is turning out 2.84 per cent of the total of all manufactured products. Judged by the following recent statistics of the Treasury Department, giving the combined net incomes of corporations for 1924, it appears that Wisconsin's recent industrial prosperity is largely dependent upon non-chemical producing or consuming industries.

Wisconsin's Manufacturing Corporations

Group	Combined Net Incomes 1924 Year
Metal manufacturing—automobiles, etc.	$34,767,033
Food products	10,385,193
Paper and wood pulp products	8,735,403
Lumber and wood products	8,059,882
Leather and leather products	4,281,753
Textiles and textile products	3,645,092
Printing and publishing	2,439,410
Chemicals	1,414,808

Since the total national net income from chemical industries is given as $466,184,064, it appears that Wisconsin partakes of this only to the extent of 0.3 per cent, while its quota on the population basis should be 2.47 per cent.

Wisconsin's seeming indifference to the chemical industries is due in part to a lack of special advantages in raw materials. For example, it ranks twenty-fourth among the states in the value of products from mines and quarries, its production of $10,581,000 being 0.3 per cent of the nation's total. One of the leading mineral assets is iron ore, of which the production was 936.000 tons for 1925, 1.4 per cent of the total. From Wisconsin's lead ore was produced in 1925, 2,802 tons of lead, 0.4 per cent of the total; and from its zinc ores 20,230 tons of zinc, or 2.8 per cent of the total.

The figures given below are taken from the 1919 census publications. Among the leading Wisconsin chemical consuming industries are:

(a) Tanning of leather, which used vegetable tanning materials costing $2,352,378; chemicals (acids, alkalis, chromates, etc.) costing $2,069,426; and oils, fats and greases, $1,060,924.

(b) Chemical wood pulp; 280,696 tons were produced in 1919. This industry used sulphur, soda ash, lime, etc., costing $2,500,000.

In the production of chemicals, as defined by the census, Wisconsin's production was $2,074,000 or 0.5 per cent of the total. In coal tar products Wisconsin is credited with $4,893,214 or 3.6 per cent. The nation's total output in "Druggists preparations" was $418,221,000; Wisconsin's share was $2,766,000 or 0.66 per cent. In the production of paints, Wisconsin's production was $6,702,000 or 2.6 per cent. Wisconsin produced 2.8 per cent of the total soap, 0.6 per cent of brick, tile, terracotta and fire clay products, 3.3 per cent of lime, and 3.3 per cent of rubber products. It takes a normal rating in the distillation of coal for municipal purposes.

From the 1923 census statistics it appears that the State's chemical and allied products were:

Manufacturing Group	Value—1923	Per Cent of Nation's Total
Paper and wood pulp	$90,923,538	10.0
Leather	46,823,815	9.6
Gas—manufactured	11,356,349	2.52
Beverages	8,488,561	3.7
Malt	7,274,566	44.3
Paints	7,234,892	2.48
Chemicals	6,036,824	0.95
Cleaning and polishing preparations	3,053,613	8.6
Flavoring syrups and bitters	1,350,975	2.7
Clay products	1,050,374	0.68
Patent medicines and compounds	1,033,762	0.43
Flavoring extracts	361,845	1.5
Druggists preparations	287,987	0.36

As to the possibilities of industrial development along chemical lines, the encouraging factors are: The need for developing new industries to take the place of those declining because of the depletion of the forest resources. Wisconsin's diversity of industry assures an excellent near-by market for industrial chemicals. The

prosperity of Wisconsin as a leading agricultural and dairy state creates a favorable market for fertilizers and indicates a plentiful supply of such classes of raw materials as are produced from the soil.

Although there is an increasing scarcity of virgin timber growth, there are 10,000,000 acres of cut-over lands, most of which is more suitable for forestry than for agriculture. These lands systematically handled may produce 1,500 lb. of cellulose per acre per year. Contrasting this with the South's yield in the form of cotton of 167 lb. per acre, and considering the recent strides in the conversion of wood into useful commodities, it is evident that these cut-over lands have enormous potential values for the development of industries such as rayon, textiles, lacquers, explosives, ethyl alcohol, and sugar.

Among the factors adverse to the development of chemical industry in Wisconsin, it must be noted that most of the raw materials for heavy chemicals, coal, oil, and metals have to be imported. Wisconsin is at a disadvantage with certain other states in potential resources in undeveloped water power. The demands for general commercial power are so fully absorbing the outputs of existing plants that really cheap power cannot be considered an inducement for large power consuming industries. Wisconsin is likewise handicapped in being off the main channel of the nation's traffic. The extra freight costs must therefore be absorbed by the industries which buy their raw materials and distribute their products in the world's markets.

Marketing Barium Chemicals

Economic and commercial characteristics of the principal compounds of industrial importance

By James B. Pierce, Jr.

Vice President, Barium Reduction Corporation, Charleston, W. Va.

THE principal barium chemicals marketed in the United States are barium carbonate, blanc fixe (precipitated barium sulphate), barium chloride, barium dioxide, barium nitrate and barium sulphide. In addition to these, small quantities of the following are occasionally traded in: barium fluoride, barium acetate, barium chlorate and barium iodide.

Barium Carbonate: About 10,000 to 12,000 net tons of barium carbonate (not including the mineral witherite) are used annually in the United States, about two-thirds of which is at the present time being imported. The greater portion of this consumption is in the brick, ceramic and enameling industries, lesser quantities being used in the manufacture of other barium chemicals, principally the dioxide, in the manufacture of steel treating compounds and for water softening.

Barium carbonate is available in two grades, light (generally preferred) and dense. There is no difference chemically between the grades; both should test 98.5 to 99.0 per cent barium carbonate and have a maximum of not over 0.2 per cent of combined sulphur and a minimum quantity of acid insoluble and alkalis. The dense, as packed, weighs about 65 to 70 lb. per cu.ft., and the light 50 to 55 lb. Barium carbonate is usually packed in jute sacks, each containing 150 to 200 lb.

The price quoted on barium carbonate today is $47.50 per net ton for car lots at Atlantic seaboard ports. The price has varied from $30 per ton in pre-war days to $80 per ton during the war with a low of $43 since the war. A petition is now before the U. S. Tariff Commission for an increase in duty under the provisions of the flexible tariff law.

Blanc Fixe (Precipitated Barium Sulphate): Blanc fixe comes on the market in two grades, viz.: (1) By-product blanc fixe resulting from the manufacture of hydrogen peroxide from barium dioxide and sulphuric acid. (2) Blanc fixe manufactured directly, usually from barium sulphide, and sometimes from barium chloride, by direct precipitation with a sulphate salt or sulphuric acid. Three to four thousand tons of the byproduct material comes into the market yearly and sells for around $50 to $60 per net ton. Much of this is of inferior quality and is not well adapted for some of the large uses, particularly that of compounding with rubber.

Approximately 6,000 tons of blanc fixe of direct manufacture is annually marketed as such and goes principally to the rubber and color industries, which with the pigment business consume about all of both the byproduct and direct manufactured material. Direct-process material sells for approximately $75 per ton. Both grades are packed in bags and barrels, the former containing from 50 to 150 lb., the latter from 250 to 500 lb.

A considerable quantity of fixe is manufactured by firms having specific uses for it and this never reaches the open market. Two of the largest of such operations are for the photographic paper industry and for special pigment purposes. This production probably runs into thousands of tons annually.

Barium Chloride: About 6,000 short tons of barium chloride appears to be this country's annual consumption. The major portion of this is imported. The principal users are the chemical, color and leather industries.

Barium chloride comes on the market as a white crystalline solid. It is generally packed in barrels or casks containing from 250 to 500 lb. The commercial grade should test not less than 99.0 per cent hydrous barium chloride and contain only minimum quantities of water insoluble and sulphur compounds.

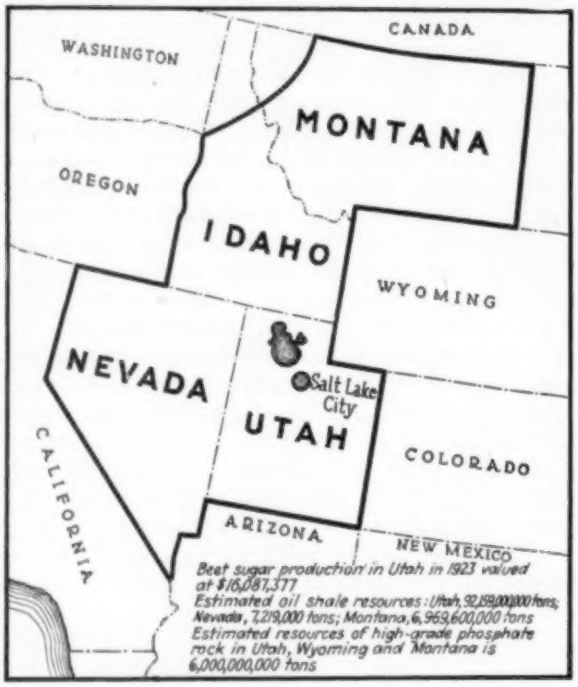
The price is about $60 per net ton at Atlantic ports for carload lots and has fluctuated from $40 in 1914 to $90 during the war period.

Barium Dioxide: From 2,000 to 3,000 tons of barium dioxide are used in this country annually, practically all being required in the manufacture of hydrogen peroxide. At the present time most of this is of domestic manufacture. Prior to the increase in tariff by presidential proclamation under the provisions of the flexible tariff law a considerable portion, probably one-half, was imported. The price is about $250 to $300 per net ton. The dioxide is packed in heavy steel drums of from 100 to 500 lb. capacity.

Exact figures for other barium products cannot be given. It may be safely estimated, however, that probably several hundred tons of barium hydrate, sulphide and nitrate are marketed annually. The hydrate finds use in water purification, the sulphide as an insecticide and the nitrate for pyrotechnical purposes. The annual use of the remaining products, fluoride, acetate, chlorate and iodide is small.

All of the barium products are manufactured from barytes (crude barium sulphate) by various processes.

Growth of INTER-MOUNTAIN *Area Handicapped By High Shipping Costs*



By Frank K. Cameron
Consulting Engineer, Salt Lake City

SALT LAKE CITY is the industrial and distributing center of an area comprising Utah, Nevada, southern Idaho, and the major part of Montana. A large proportion of the acreage is Government land the only present economic value of which is in the grazing it affords. There are no large cities within the area. The major industries besides stock raising and hay production are orcharding, the growing and processing of canning crops, the growing of beets and the production of beet sugar, petroleum refining, mining, milling and smelting ores and the manufacture of cement. To these should be added, as of scarcely secondary importance, the production of Grimm alfalfa seed at Delta, in the southeastern section of Utah, and in the Uinta Valley in the northeastern part of the state, the mining of gilsonite and heavy hydrocarbons of similar characteristics.

The normal population is small and thinly scattered over the area with relatively greater concentration in the principal agricultural valleys and mining camps. There are a number of small cities and towns scattered through these valleys, each of local importance but of no great industrial interest, aside from Salt Lake City.

Consuming Market of Limited Requirements

The agricultural activities are of minor interest to the chemical manufacturer since practically no fertilizers are used. There is a fair but vacillating market for insecticides, cattle dips, and weed killers. At various times more or less of these products have been manufactured within the area, but at present practically all are shipped in, excepting white arsenic which is used to combat grasshoppers and beetle infestations and to some extent to kill mosquito larvæ, and sodium arsenite which is used in increasing quantities as a weed killer by farmers, agricultural agents, irrigation companies and railroads, the last being the largest users. More and more, it is coming into use as a cattle and sheep dip.

This area affords an excellent market for explosives, not only for the numerous and extensive mining operations within it but also for the large aggregate of construction operations underway. By far the major part is shipped into the area although at Backus, Utah, about twenty miles from Salt Lake City the Hercules Powder Co. operates a well-equipped plant for making explosives. There is also a growing market for flotation oils, xanthates, and similar mill supplies. Some of these latter are and will always be produced locally, but for the most part consumers must depend upon outside sources of supply. There are three plants for wood preservation which obtain their creosote and zinc chloride from outside sources.

In other respects the communities in this area are normal consumers of the products of chemical and allied industries depending in the main upon outside manufacturers, although there are several manufacturing operations within the area which supply part of the demand. In the aggregate, the market is not an imposing one, and detailed statistics are of no great general interest. Far otherwise, however, is the case when attention is directed not only to the actual but more particularly the potential possibilities of the area for chemical manufacturing from its own resources.

Disadvantages of Distance

Since this area is one to be exploited both agriculturally and industrially for distant consuming markets, any raw material or manufactured product can find a sale in competitive markets in substantial amount only if it can bear a relatively high freight charge to that market. For the most part these rates are not known and cannot be intelligently guessed, since the railroads cannot be required or induced to make rates on hypothetical cases. For instance, the writer was advised recently that a Kraft paper industry of imposing proportions would be quickly developed in the South Atlantic states if an adequate supply of sodium sulphate could be obtained there at $18.50 per ton. There are practically unlimited quantities of this substance to be obtained at Great Salt Lake—not only from the lake waters but in immense solid deposits at many points on its shores and under its bottom. Sodium sulphate

could be shipped in quantities and in unusual purity at a cost of $3 to $4 per ton at the loading point. But the enquiry languishes for want of an authoritative statement of what the freight rate would be.

Again, capital investment in this area is and probably must be largely that of non-resident owners, consequently a relatively large proportion of the earnings of an enterprise will be permanently lost to the area. But of as great importance is the fact that the enterprise, especially in its early stages, lacks that interested supervision and sympathetic support so often essential to success, and which can come only from actual ownership. More than one of the supposedly wildcat enterprises, the failure of which has tended to discourage investment in this area, has been really sound technically, but inadequately or mistakenly directed because of conditions inseparable from absentee ownership.

Power and Fuel Resources

The power resources, potentially, are more than adequate for any conceivable industrial development. Hydroelectric power is not now nor probably ever will be cheap enough in this area to be used in electrochemical production. In exceptional cases and for relatively small-sized operations it may be used as is the case of a development in one of the canyons near Salt Lake City of about 1,200 kw. which is used for the production of liquid oxygen by the electrolytic decomposition of water. There is at least one electric furnace for melting steel in operation in a foundry at Midvale.

Coal is available in any desired quantities and at prices which seem almost fabulously low to the consumer accustomed to the prices prevailing in existing large centers of chemical industries. Paradoxically, the growth of industry in this area may be accompanied at first by an increase in fuel cost for there is now an overproduction of slack and similar grades.

Fuel oil is available. Very large quantities of oil shale will be available when the need for it develops. Petroleum and natural gas are available. Southeastern Utah has several large gas wells and a large supply of natural gas from Wyoming and the northeastern part of Utah could be made available to the Ogden-Salt Lake territory should there be an industrial development justifying the building of a pipe line.

Arsenic, Selenium and Cadmium as Byproducts

Dominating the situation in this area, from a chemical point of view, is the group of copper and lead smelters within thirty miles of Salt Lake City, and the concentrating mills which feed these smelters. All the copper and lead produced, with the silver, gold, and sometimes platinum therein, is shipped to distant refineries. But certain byproducts are recovered at the local installations. The copper smelter of the American Smelting & Refining Co. at Garfield, can supply the world's requirements of selenium and probably could meet a large demand for tellurium, were it financially worth while. Cadmium is recovered more or less sporadically at the lead smelter of the U. S. Smelting & Refining Co. at Midvale.

More interesting is the large production of arsenic at the lead smelters since the raw arsenic recovered at the copper smelter is sent to the lead smelter for further treatment. This group of smelters is probably the largest existing source of arsenic in the world, although Anaconda might be forced to rival it closely, and some of the Mexican smelters might surpass it if the market justified a maximum production. The smelter at Midvale is equipped with an arsenic refining plant having a capacity of more than 300 tons per month, and the smelter at Murray ships "black dust" equivalent to 600 to 700 tons of white arsenic per month to the refinery at Globe, Colorado. In this connection should be noticed the large deposit of scorodite or ferric arsenate as well as arseno-pyrites at Gold Hill—about 120 miles west of Salt Lake City. This is the only known deposit of scorodite in minable quantities, and sodium arsenate can be recovered from it directly by treatment with a hot concentrated solution of caustic soda, as was done for two years in a plant near Salt Lake City. At present prices for arsenic, however, this project is not financially feasible.

There is an irregular but considerable recovery of zinc concentrates at various mills in this area, but all is shipped out of the area for smelting. Electrolytic zinc has been produced at Park City and at Murray, but is not practicable because of relatively high costs for current. Several plants for the production of zinc oxide (leaded) were erected in the area during the war period—a large one near Salt Lake City—but they are not now operating. It has been proposed to produce zinc chloride for the wood-treating plants in this area, but there is no hydrochloric acid made in the area, the sugar mills being the only important consumers. They bring in only about 200 tons per year. Other possible methods of making zinc chloride have not been carried beyond the laboratory stage of development.

Sulphuric Acid Goes to Waste

Next in importance, in the public mind at least, is the production of sulphuric acid. Statements, more or less true, that the smelters about Salt Lake City discharge from their stacks daily the equivalent of from 6,000 to 10,000 tons of concentrated sulphuric acid do not necessarily mean that a large quantity of very cheap acid can be made advantageously. In the first place, the stack gases contain only about 1.5 per cent of sulphur dioxide, a concentration far too low for economical acid production, and there is no evidence that the gas can be economically concentrated. It is further held by the smelter operating staffs that to produce a concentration suitable for acid manufacture would seriously reduce the metal production as well as shorten the campaign of the roasters. The enterprise accordingly holds little appeal for them. In the second place, there is no market available. The ore leaching operations in this area require but a small tonnage. The general replacement of acid flotation by alkali flotation processes has destroyed the market anticipated a few years ago.

The one important consumer remaining is the Columbia Steel Co., whose plant at Ironton, near Provo, makes about 12 tons daily of ammonium sulphate as a byproduct of its coke ovens. The Hercules Powder Co. at Backus has a contact acid plant and the Garfield Smelter has a chamber plant with concentrators capable of producing 100 tons daily of 60 deg. Bé. acid. It also operates more or less intermittently and at far from maximum capacity. It is doubtless true that with large and steady production, with consequent lowering of fixed charges and due allowance for all considerations, fairly cheap acid could be made by the smelters; but the incentive is wanting and there seems to be little

likelihood that these smelters will ever become important acid producers.

Large deposits of sulphur have been located in Utah and Nevada and acid could well be made outside the smelter, should the need for it develop. Nevertheless, the great production of sulphur dioxide is a local resource now wasted entirely, and therefore inviting research. A suggestion now under investigation is to pass the stack gases through or over water in contact with phosphate rock. The rock is dissolved entirely excepting for siliceous and other adventitious material. The calcium can be precipitated by adding sodium sulphate, leaving a solution from which mono-sodium phosphate can be recovered on evaporation. This salt might find a market for making baking powders, rust preventives, etc., or even concentrated fertilizers. In this way, three of the local resources not now marketable, might find a useful and probably profitable outlet.

Byproduct Coke Industry Established

At Ironton, near Provo, and about fifty miles south of Salt Lake City, the Columbia Steel Co. has a modern and fully equipped blast furnace for reducing the oxidized iron ores of southern Utah, and with it operates a Koppers byproduct coke-oven installation. All the byproducts are now recovered excepting a part of the 8,500,000 cu.ft. of gas produced daily, and ultimately all of this will be used. The company is engaged in research with a view to increasing the value of its byproducts. The Republic company is utilizing the tar produced by the coke oven. The gas plants (municipal) at Salt Lake City and Ogden also recover the byproducts, all of which, excepting the coke, are shipped out of the area.

There are several oil refineries at different points in the area working up available supplies of petroleum for local consumption. A fully equipped refinery located at Salt Lake City, belonging to the Utah Oil Refining Co., treats about 3,000 bbl. of crude oil daily. This refinery offers no features of exceptional interest. The same may be said for the fifteen or more sugar mills mainly in Utah, and for the portland cement plants at Devils Slide, Brigham City, Ogden and Salt Lake City. All these plants operate by standard methods. More interest attaches to the flour mills, vinegar plants and the canneries, but it would lead too far from the purpose of this survey to discuss the details.

Noteworthy, is a well-operated plant making liquid carbon dioxide in Salt Lake City, but the rapid development and use of small electrically operated ice machines seems to limit its market to the preparation of soft drinks. In addition to the plant referred to above, there is another at Salt Lake City making oxygen and also hydrogen for the use of welders.

Soaps have been made in local plants but these operations have practically ceased. Water softening plants for laundrys and small municipalities are using various standardized procedures. Municipal water supplies are chlorinated.

Resources of Chemical Interest

From a strictly chemical viewpoint, the major interest in this area lies in certain undeveloped resources which are amazing in variety and extent. Scattered throughout the area are known occurrences of such substances as natural sodium carbonate and bicarbonate, sodium nitrate, barite, and strontianite, sulphur, absorptive clays, pure gypsum, limestone and even platinum. In a few cases success has been achieved as in the making of plaster or Keene cement from the gypsum, or of hydrated lime of exceptional purity from the limestone; but quite generally, lack of water, transportation or market, or cost of recovery make exploitation impracticable.

Throughout the area, but particularly in southern Idaho and northern Utah, are vast deposits of phosphorites. Some of the veins surpass in average content of phosphorus the famous Ocean Island deposits. Development has been slow although there was great activity in the war years. The Anaconda Copper Co. has a well-equipped mine near Soda Springs, the major part of the output going to Anaconda, Montana, to be made into "treble super" which can bear the freight to consuming points, while this would be impossible for ordinary acid phosphate. There is an occasional production from the Mountain Copper Co.'s workings near Montpelier and from the Idaho Phosphate Co.'s well equipped mine in Bloomington canyon near Paris. All other workings have ceased operations, and their future development appears to depend on the successful working out of a process for recovering phosphoric acid by volatilization, adsorption of smelter fumes, or something yet to be devised. Undoubtedly, finely ground rock phosphate could be used to advantage in the fruit growing sections of the northwest.

Abundant Potash Resources

The potash resources of this area are also of imposing magnitude. Scattered throughout the entire area, but particularly in the desert regions of Utah and Nevada, there is many a lake or salt deposit containing enough potassium to make it commercially noteworthy, were it in some more favored location. The abandoned operations at Solduro and Arizona, as well as those on the shore of the Great Salt Lake, furnished convincing evidence that potash can be obtained, although not economically under present market conditions. The same situation applies to the very large deposits of alunite in the Tushar Mountains which are not commercially available since the potash content will not justify utilizing this material as a source of alumina in competition with bauxite. The enormous and readily accessible leucite deposits are not available because of the long rail haul of the finished product to consuming points, although it has been shown that they are a relatively cheap source of potassium salts through the application of the Lemburg reaction as developed by the research staff of the Armour Fertilizer Works, or some modification of the Italian technology.

More alluring are the chances of finding deep seated deposits of dry potassium salts resembling those of Alsace or North Germany, the prospect appearing favorable since the finding of potassium chloride in borings for oil near Thompsons, Utah. But even should further borings demonstrate the existence of workable potash deposits, and the rather large capital be secured which European experience shows to be necessary for successful exploitation, there is great doubt whether the salts could be shipped to consuming points in competition with European supplies because of the long rail haul.

In hydrocarbons the area is peculiarly rich, but oil developments so far, while important, have fallen short of expectations. Nevertheless, very large natural gas

reserves have been found and although having no immediate market are potentially of great importance with the rapid development of petroleum chemistry. Incidentally, at Woodside, Utah, has been located the richest known source of helium. Gilsonite, ozokerite, and similar products, are shipped from Utah, and seem to find an assured market, but offer no immediate prospects for local manufacture. Enormous quantities of oil shale in Utah and Nevada, as well as in Colorado, hold great prospect for future operations. The coal measures of this region are in the aggregate an immense storehouse of potential energy and raw materials for a chemical industry. Vast as these reserves are, it is no less than a crime against posterity that coal should continue to be coked in beehive ovens without the recovery of its byproducts.

The Great Salt Lake itself is an immense storehouse of chemical raw materials for future utilization. At present two enterprises are commercially successful in recovering sodium chloride, partly by solar evaporation. Recovery of potassium chloride has been demonstrated to be practicable technically, although not economically. Recovery of magnesium salts face marketing difficulties only. If, as appears possible, sodium sulphate from this source may find a considerable market, it may be that some recovery of the other components of the Lake will prove to be feasible.

Merely to catalog the resources in raw materials and future opportunities for manufacture in this area would transcend any reasonable limits for a review of this kind. From what has been here recorded, however, it appears that, aside from the operations of the smelters and sugar mills, a chemical industry is steadily developing in this area which is in keeping with local capacity to absorb its products. But the rather tremendous possibilities suggested by the wealth of raw materials completely obscures what achievements have been made or attempted.

Unusual Steam Supply System For Gas Generators

The new water gas plant of the Public Service Corporation of New Jersey at Harrison, N. J., has some novel features in connection with its use of steam. High-pressure steam for the turbines and engines that drive compressors, exhausters, pumps and other equipment is produced by stoker-fired boilers fueled with coke breeze or fine anthracite and waste heat boilers attached to each generator.

The generators are supplied with exhaust steam from the high-pressure auxiliaries. Interposed between the auxiliaries and the generators are two steam accumulators, which serve to maintain a constant pressure on the low-pressure steam fed to the auxiliaries. These accumulators are each designed to store 900 lb. of steam of a pressure ranging between 7½ and 15 lb. per sq.in. gage.

Provision is made for augmenting the supply of steam to the accumulators by bleeding the first stage of the turbines used to drive the exhausters and by feeding in high-pressure steam direct from the boilers. In this way a sufficient supply of low-pressure steam for the generators is assured. Should the exhaust from the auxiliaries be in excess of the generator demand at any time a relief line is provided to exhaust this excess to the atmosphere.

Protection of Pipe Materials from Soil Corrosion

In the *A.G.A. Monthly*, March, 1927, W. H. B. Gardiner analyzes the recent report of the Bureau of Standards on "The Effects of Soils on Pipe Materials" in part as follows:

About five years ago this bureau, in co-operation with a number of makers and users of iron and steel pipe, undertook an extensive study of the effects of soils on pipe materials, this study embracing the effect on the metal itself, on metallic coatings and on bituminous coating materials. In the early part of December, 1926, the first report on this investigation was given out at the annual meeting of the American Petroleum Institute. This report covered bituminous materials only.

Between the years 1922 and 1925 coated test pieces of pipe were buried in forty-eight localities covering a wide variety of soil conditions. Eight different coating materials were used, but in some cases the application was modified or varied so that fourteen methods of pipe protection were actually under investigation.

The tests as conducted were essentially of bituminous materials themselves, without particular regard to their availability as pipe coatings in the field, as the conditions of application were ideal and were calculated to give the best results of which the coatings were capable, whether or not such conditions would be duplicated in practice.

In spite of this fact, however, the report is of great value in at least one particular. This may be regarded as negative. While the materials or methods which proved satisfactory in protecting the pipe under the ideal conditions prevailing would not necessarily prove adequate under normal field conditions, those which failed under the test hold no prospect of satisfactory service under the conditions imposed by field practice.

The coating materials used included asphalts from Midcontinent, Mexican, Texas and California crudes, in some cases mixed with gilsonite and in one case with stearine pitch. There were two coal tar pitches used and one pitch from refined water gas tar.

A close analysis of this report and the tests with which it deals seems to justify the following conclusions:

1. Whatever bituminous coating is used it should be applied in a heavy coat—from $\frac{3}{32}$ of an inch upward.

2. High melting point asphalts refined by air blowing lack adhesion. A study should be made looking to the use of low melting point steam distilled asphalts and to effective economical means of overcoming existing objections and difficulties of transportation.

3. Asphalts refined from heavy Mexican crudes hold out the greatest promise as pipe coating materials.

4. Thickness for thickness asphalts refined from proper crudes are somewhat more effective than coal tar pitch although the adhesion of coal tar pitch is slightly better than that of the high melting point blown asphalts now in use.

5. Coal tar pitch will prove a satisfactory coating only if it is so wrapped that it will be confined. Placed in a heavy coat it will flow off the top and sides; placed in a thin coat it will deteriorate rapidly.

6. Fabric wrapped coatings last longer and give better protection than when the same coatings are not wrapped. But because of the tendency of fiber wrappings to rot under ground, efforts should be made to devise a wrapping or casing of permanent character.

On the Engineer's Book Shelf

Chemistry of Hydrous Oxides

THE HYDROUS OXIDES. International Chemical Series. By *Harry B. Weiser*. McGraw-Hill Book Company, Inc., New York. 452 pp. Price $5.

Reviewed by Ross Aiken Gortner

The author defines "hydrous oxides" as follows: "Precipitated oxides like ferric oxide which contain varying amounts of water adsorbed by the oxide particles are called hydrous oxides to distinguish them from hydrates, in which the water is chemically combined in definite stoichiometric proportions. . . . On standing, the primary colloidal particles of the hydrous oxides grow and lose water spontaneously, causing the mass to assume a less gelatinous and more granular character."

Probably no one in America is so well qualified to write on the hydrous oxides as is Doctor Weiser, for he has gained for himself an international reputation by his researches in this field. The present volume bears evidence of a complete knowledge of the literature combined with the judicious judgment of a careful research worker. The author presents in a clear manner the various theories which may have a bearing on the phenomena under discussion but at no time does he leave the reader in doubt as to his own personal viewpoint. Consequently the book is more than a compilation of data, and is correspondingly the more valuable.

The book is divided into nineteen chapters. The first chapter is a general discussion of "Jellies and Gelatinous Precipitates," dealing with the preparation of gels, their structure, and volume and vapor tension relations. The hydrous oxide gels of iron, chromium, aluminum, gallium, indium, thallium, copper, cobalt, nickel, silver, gold, beryllium, magnesium, zinc, cadmium, silicon, germanium, tin, lead, titanium, zirconium, thorium, the rare earths, vanadium, columbium, tantalum, antimony, bismuth, molybdenum, tungsten, uranium, manganese, and the platinum metals are discussed in Chapters III to XIV inclusive. The book closes with special chapters on tanning, mordants, water purification, cement and the soil. The book contains numerous literature citations, and there is appended both an author index of more than 1,200 names and an extensive subject index.

While this volume cannot be regarded as having been written from the industrial chemical viewpoint, nevertheless many examples of industrial application or of industrial practice are scattered throughout the text. The adsorptive properties of the gels are stressed and the industrial uses of silica gels are well illustrated. The author concludes (p. 365) that "mordants function by adsorbing dyes in indefinite proportions depending on the conditions," and (p. 325) that "the most plausible theory of chrome tanning is that the hide fibrils adsorb from the tan liquor hydrous chromic oxide or basic salt which subsequently ages, giving a protective coating." In a discussion as to whether or not definite protein-chromium compounds are formed in the tanning process, Weiser takes the view that adsorption accounts best for the data (p. 332): "The important thing is that the maximum in the continuous curves should not be construed as indicating the formation of definite chromium collagenates any more than any other point on the curve. At suitable points on the curve, a whole series of definite salts from monochrome to octachrome collagenate may be assumed to exist; but this does not indicate, let alone prove, their existence."

If there is any fault to be found with the book, it is that certain chapters are too brief. This is certainly true of the first chapter and the last five chapters where general theory and certain applications are stressed. One would like Weiser to treat these subjects at greater length, and it is to be hoped that he will expand them in the next edition.

It is a live book, a credit to the author and the International Chemical Series and should be on the desk of everyone interested in colloids or inorganic chemistry. Even the biologist will find in it much that is worth while, for the behavior of these inorganic gels reflects in many instances phenomena which are characteristic of the much more complex biological systems (for example, note Fig. 16, p. 257).

Chemistry of Cellulose and Wood

THE CHEMISTRY OF CELLULOSE AND WOOD. By *A. W. Schorger*. McGraw-Hill Book Company, Inc., New York, 1926. 596 pp. Price $6.

Reviewed by G. J. Esselen, Jr.

The aim of this book, as expressed in the preface, is "to cover completely the scientific and empirical data available on the chemistry of wood. This has necessitated the inclusion of cotton cellulose and its modified forms. Industrial processes are treated mainly from the side of the fundamental reactions involved." The author has lived up unusually well to the goal which he thus set for himself, as is well illustrated by citing the chapter headings: The Structure, Formation, and Physical Properties of Wood; The Composition of Wood; Lignin; Color Reactions of Wood; Hemicelluloses and Wood Cellulose; The Constitution of Cellulose; Gelatinized Cellulose; Oxycellulose; The Action of Acids on Cellulose; Saccharification of Cellulose and Wood; The Action of Various Reagents on Wood; Pulp Processes and Wood Pulps; The Distillation of Cellulose and Wood; The Fermentation of Cellulose and Wood; Digestion of Cellulose and Wood by Animals; Analytical Methods.

In reading the book one cannot help being impressed by the thorough manner in which every subject is dealt with. In practically every instance, the historical phase of the subject is adequately considered, and this is followed by a discussion which has a very wide viewpoint. All the important work is considered and correlated as well as may be. Furthermore, the usefulness of the book is considerably "increased by the detailed statement of the conditions under which certain results were obtained."

The book serves a valuable purpose by presenting in

convenient form the important published articles. From the point of view of one who is not familiar with cellulose, it would probably have been an improvement if the author could have been a little more critical in his discussion of some of his citations. For many readers of course, who prefer to draw their own conclusions, this will not be a disadvantage.

Thermodynamics for Chemistry Students

THERMODYNAMICS FOR STUDENTS OF CHEMISTRY. By *C. N. Hinshelwood*, fellow and tutor of Trinity College, Oxford. E. P. Dutton & Co., New York. 185 pp. Price $1.80.

Reviewed by Barnett F. Dodge

We were first inclined to question whether another text book on thermodynamics such as this, had any real excuse for existence, but before delving very far into it, it appeared to us to present old truths in such an illuminating way as to completely justify its existence. It is far from being an exhaustive treatise on the subject and only aims to present the fundamentals in as simple a manner as possible, and to deal concisely with a few of the more important applications to simple chemical problems. In this it seems to us to have succeeded admirably. Instead of giving a purely formal treatment of the subject, the author has attempted to give a clear physical picture of the meaning of the various relations. Considerable stress is laid on the kinetic interpretation of thermodynamic relations, which should be a valuable aid to the beginner in visualizing their meaning. One criticism that might well be made is the dearth of illustrative numerical problems. On the whole, it seems to us to be one of the best elementary treatments of the fundamentals of thermodynamics and their application to simple physico-chemical systems, that has been published.

Practical Colloid Chemistry

PRACTICAL COLLOID CHEMISTRY. By *Wolfgang Ostwald* in collaboration with *P. Wolski* and *A. Kuhn;* translated by *I. N. Kugelmass* and *T. K. Cleveland.* E. P. Dutton & Co., New York. 191 pp. Price, $2.25.

Reviewed by Brian Mead

This little book is apparently a translation of the Fourth German Edition, the three previous editions having been exhausted within two years. The general layout of the book can be seen from the following sectional headings: Preparation of Colloidal Solutions; Diffusion, Dialysis and Ultrafiltration; Surface Tension and Viscosity; Optical Properties, Electrical Properties; Experiments with Gels; Adsorption; Coagulation, Peptization and Related Phenomena; Commercial Colloids and the other material for Demonstration Experiments; Dispersoidal Analysis.

In general, it may be said that there are two methods of writing laboratory manuals. In the first of these, the theory underlying the experiments is briefly mentioned, or is not mentioned at all, but full experimental details are given. The inference is that such a book is useful only when co-ordinated with a lecture course along identical lines. This type of book strongly resembles a cookery book. The second, and preferable, type gives more references to the original literature and chooses the experiments so as to make the theory clear. An example of the latter type is Holmes' Manual, while the book under review is in the former category. That it has some application for beginners in the subject cannot be denied, but that it will find a wide application in American schools is doubtful.

In every new book certain omissions are apparent to a reviewer. In the present case, the lack of experiments on emulsions is striking. It is through emulsification phenomena that most people first become acquainted with colloidal phenomena; therefore it would seem advisable to have a few experiments dealing with this phase of the science. In connection with experiments on stalagmometry, there is no mention of the influence of time of formation on drop size. Neglect of this variable is likely to give unsatisfactory and unreliable results.

The book is well printed and apparently free from errors.

PHYSICO-CHEMICAL METHODS. By *Joseph Reilly*, professor of chemistry National University of Ireland (University College, Cork), *William Norman Rae*, professor of chemistry, University College, Columbo and *Thomas Sherlock Wheeler*, chemist research Dept., Royal Arsenal, Woolwich. D. Van Nostrand Company, New York. 735 pp. Price $8.

"Physico-Chemical Methods" is an extended manual for experimenters. It is perhaps the most complete book on technique that has ever been produced, at least in the English language. Although written primarily for the advanced student, the book contains such a wide range of information that it should appeal to research chemists both in university and in industry.

The book contains more than 400 illustrations, and the complexity of methods ranges from the use of a micrometer to X-ray analysis and refined methods of electromotive force measurements. Some of the representative topics covered are: "Experimental Errors"; "Nomography"; "The Slide Rule"; "Stirrers, Shakers and Centrifuges"; "Ovens and Evaporators"; Thermostats"; "Pumps"; "Determination of Melting Point"; "Distillation"; "Photography"; "Angular Measurement and Area"; "Time and Its Recording"; "Gas and Mercury Thermometers"; "Thermocouples"; "Measurement of Surplus Tension"; "Viscosity"; "Measurement of Pressure"; "Distribution or Partition Coefficients"; "Manipulation of Gases"; "Calorimetry"; Polarimetry"; "Spectrometry"; "Colorimetry and Nephelometry"; "Photometry"; "Electromotive Force Measurement"; "X-Ray Analysis"; and "Practical Methods in Colloid Chemistry."

Colloid and Capillary Chemistry

COLLOID AND CAPILLARY CHEMISTRY. By *Herbert Freundlich*, professor at the Kaiser Wilhelm Institute for Physical Chemistry, Berlin; translated from the Third German Edition by *H. Stafford Hatfield.* E. P. Dutton & Company, New York. 883 pp. Price $14.

Readers of the German chemical literature have long been acquainted with Professor Freundlich's valuable contributions to colloid chemistry. Fortunately, his well-known "Colloid and Capillary Chemistry" is now available in the English, thanks to the efforts of Dr. Hatfield.

The book is divided into the following main parts: Capillary Chemistry; The Kinetics of the Formation of a New Phase; Brownian Molecular Movement; Colloidal Solutions; Sols and Gels; Mist and Smoke; Foams; and Disperse Structures with Solid Dispersion Media.

Although the book contains important references to the periodical literature, these are well chosen and are discussed with remarkable clarity and good judgment.

Readers' Views and Comments

An Open Forum

The editors invite discussion of articles and editorials or other topics of interest

The Atmospheric Nitrogen Industry

To the Editor of Chem. & Met.:

Sir—"The Atmospheric Nitrogen Industry," by Dr. Bruno Waeser, recently published in English by P. Blakiston's Son & Co. of Philadelphia, from a translation made by Ernest Fyleman, Chief Chemist to J. F. Crowley & Partners, should attract unusual attention at this time when the subject is so often referred to in connection with commerce, agriculture and explosives.

I have been identified for more than thirty years with the development of the American chemical industry, and cannot therefore refrain from commenting upon some of the misleading statements, more particularly those dealt with in Chapter XI, Part One, entitled "The Development of the Nitrogen Industry in the U. S. A." For example: On page 260, it is stated that in 1914, 6,000,000 tons of chemicals were manufactured in the United States of the value of $2,500,000. Does anyone know of any chemical product that can be mined or manufactured for 40c. a ton? In 1917, it is stated that the tonnage was 46,000,000 tons of a value of $57,000,000, or $1.25 per ton, which is obviously preposterous. On page 261 it is stated that potash fertilizer from Nebraska was sold in the United States at $12.50 per ton. Where were such sales made? The freight alone from Nebraska to the consuming centers would almost amount to that figure.

National Aniline & Chemical Co. Not Financed with German Capital

On page 286 it is stated that the General Chemical Company acquired a considerable influence in the National Aniline & Chemical Company during the war, the latter company having been founded with German capital. This must surely be classed as a wild assumption, as the National Aniline & Chemical Company was built and had for years been controlled by the Schoelkopf family; the senior and head of which, as well as all his brothers were born in America. Furthermore, it would have been seized by the Alien Property Custodian, if it were even half German. It is further stated on this page: "In 1920 a formal amalgamation took place of the General Chemical Company, the Barrett Company, the Semet-Solvay Chemical Company and the National Aniline Company. The new company is said to have a capital of $350,000,000." Is it then implied that the German influence continued?

Government Nitrate Plant at Sheffield Not a Failure

Page 282, with repetition in pages 300 and 485, states that the U. S. A. Government's Nitrate Plant No. 1 at Sheffield, Alabama, which was to have operated a *Haber* Process was a "complete failure." Quite contrary was the case. The Haber Process owned by the Badische Aniline & Soda-Fabrik was developed on Haber's exposition that the synthetic reaction equilibrium of ammonia made it uneconomic to attempt the manufacture of synthetic ammonia at pressures less than 200 atmospheres. Hoping to control this industry, they had successfully secured world-wide patents that allowed claims, giving them an apparent monopoly of pressures of more than 100 atmospheres.

The General Chemical Company, therefore, set out to determine whether pressures less than 100 atmospheres could be employed economically, notwithstanding the Badische's contention. They had naturally followed closely the research dealing with combining nitrogen, and in 1912 had created a special laboratory for synthetic ammonia studies. By 1916 they had made such progress in the operation of a pilot unit that they concluded to appropriate about $1,000,000 for a larger manufacturing unit.

Before the apparatus had been delivered in 1917, by which time the United States had entered the World War, the Government solicited the privilege of erecting an ammonia unit of ten tons daily capacity, to determine whether the process had reached a stage that would justify its adoption for war purposes. Subsequently, two additional units were decided upon as the Government's confidence had grown while the working plans progressed.

The first unit was only just coming into operation at the time of the Armistice, and was not run for any length of time thereafter, as after many months' discussion it was found impossible to effect arrangements free from Government interference, that would render success possible.

Muscle Shoals Ammonia Plant Did Not Use Haber Process

The No. 1 ammonia plant erected at Muscle Shoals was designed to operate at pressures below 100 atmospheres and employed a catalyst never before used. It can hardly, therefore, be properly classified as a Haber Process. Furthermore it did produce enough ammonia to satisfy the experts of its success. Only certain mechanical defects needed correction, and these the General Chemical Company undertook to carry out at their expense, if given reasonable time to perfect the changes.

This is the explanation of the so-called "failure." The real facts, however, are that in the opinion of the experts of the General Chemical Company the process fully justified expectations, and this conclusion was accepted by their Directors.

The Atmospheric Nitrogen Corporation was therefore formed in 1920 with the co-operation of the Solvay Process Company, as their broad interest in coke and ammonia was deemed of greater importance for future development than the selection of a site such as Muscle Shoals where cheap power was the only factor.

As Director of Research and Development in the General Chemical Company until the end of 1921 and responsible for the success of the synthetic ammonia venture, I feel called upon to give the above facts which are well known and easily verified.

The work of Mr. de Jahn and his assistants should be widely known. He has been the American pioneer in this field and was responsible for the design and construction of the first plant built in America at Syracuse. Never has a chemical plant worked more successfully from the first. The studies carried out under his direction, commencing in 1912, demonstrated conclusively that with pressures of less than 100 atmospheres, it is possible to secure reactions carrying higher NH_3 contents in the combined gas than was practised by the Badische Company.

These important practical results are the more notable when considering former misgivings as to such high pressures at such high temperatures. His work has brought out unexpected and definite facts that are invaluable, particularly in connection with hydrogen-nitrogen mixtures produced from coke or other fuels.

I believe there can be no dispute in the following facts:

1—No plant has been erected before or since where hydrogen was produced from coke of a purity that made it possible to use the same catalyst year in and year out. To this day Badische, Casale and Claude are known to change their catalyst every few months, and have had to work out a mechanical operation to simplify this very serious objection.

2—Notwithstanding Haber's contention that the synthetic equilibrium requires approximately 200 atmospheric pressures to be successful, the Badische, in actual operations, has found it advantageous, as already stated, to use high velocities, giving them less than one-half of the NH_3 contents in the gases leaving the converters than is the case at Syracuse where lower pressures are employed. So the very theory, so far as conversion equilibria are concerned, has over a period of five and a half years shown that the Badische's original economic contentions were not justified.

3—It is now quite possible to control temperatures in single units having a capacity of 60,000 lb. synthetic ammonia or over in twenty-four hours.

Important Developments in France and United States Slighted

Dr. Waeser, in his preface, states that he has been able to deal with the literature up to the middle of March 1921, up to which time as is well known, Germany was the only factor in the production of synthetic ammonia.

The translator, however, says that Dr. Crowley deals with the considerable developments since the war. It is surprising therefore in 1926 to find such meagre references to the United States and France. Dr. Crowley lays stress on what he calls the most outstanding development of recent years—the progress of the Casale Process, though that has dealt only with the combination of nitrogen and hydrogen, with little or no attention to the production of cheap hydrogen by the various processes, notwithstanding that hydrogen is the all-important element in the manufacture of synthetic ammonia.

Claude's work, also of the utmost importance, is hardly referred to, though Claude has not limited himself to Badische's pressures, but gone enormously higher. The 1,000 atmospheres he employs call for great engineering skill and indomitable courage. That he has splendidly overcome the difficulties incident to lubrication, joints and valves is well known. He therefore has the most compact and economical conversion apparatus.

Henry Wigglesworth,
Consulting Chemical Engineer.
New York, N. Y.

Shall We Abolish Patent Trusts?

To the Editor of Chem. & Met.:

Sir—I have noted with interest the discussions in recent issues of your journal under your heading, "Shall We Abolish Patent Trusts?"

It sounds dangerously close to a "squeal" for any highly-educated man posing as a commercial chemist, to desire our present patent laws to be changed for fancied inequality of opportunity, as between the men serving at a fixed salary in a great research organization, whether fostered by government, industry or educational organizations, and those alleged poor men in research work of any kind.

As long as chemists will take $5,000 for a formula on which a new industry may be based, with the lawyers drawing up the organization papers taking $250,000 and with the bankers hustling around to raise the funds taking $1,000,000 out of a $5,000,000 organization, just so long will chemists and engineers hold the market values now placed on their services.

Until inventors or individual patent owners are capable and willing to go through the tremendous effort it now requires in pioneering in any field, are willing to fight those pirating their constitutional property rights to a finish, compelling these so-called infringers of patents (which of course must be intelligently as well as legally drawn) to make restitution to the fullest degree, the same as other confiscators of property rights, just so long will one expect to see the academic discussions along the lines of those I have recently noted.

The size of the trusts under patents makes them vulnerable to the exact degree of their size even with good patents, whenever any individual in or out of other organizations can develop real new science, good inventions, and good patents based thereon. Certainly no man may say that the Federal Courts have ever refused to give inventors and patent owners their due where real merit exists, and where they can intelligently present the merits of their contentions, and I do not believe the judges ever are influenced in the slightest degree as to whether the litigants are rich or poor.

William P. Deppé.

Deppé Motors Corporation,
New York, N. Y.

An Unauthorized Solicitor

To the Editor of Chem. & Met.:

Sir—We have been informed that a man using one of the following names, Cummings, Butler or Burton, has been representing himself as employed by or a former employee of the Tolhurst Machine Works. He used a business card bearing our name and address together with the name "Cummings."

Will you kindly publish in a prominent position in *Chemical & Metallurgical Engineering* a notice that the man is an impostor, as he is not nor ever has been employed by this concern under the name "Cummings."

R. K. Cheney,
Sales Manager,
Tolhurst Machine Works.
Troy, N. Y.

Selections From Recent Literature

Utilizing Ocean Heat. Georges Claude and Paul Boucherot, *Comptes rendus*, Nov. 22, pp. 929-33. Enormous floating power plants, generating power from steam turbines by pumping up cold water from great depths and boiling it under low pressure at the temperature of the surface water, could generate large quantities of energy very cheaply in tropical waters. The available temperature gradient indicates a power output equivalent to that obtained from a like quantity of water falling 100 meters. France is urged to exploit this cheap source of power for the benefit of her colonies. Comments by P. Villard, *Comptes rendus*, Nov. 29, pp. 1001-2.

Nitrifying Steel. Leon Guillet, *Comptes rendus*, Nov. 22, pp. 933-5. Surface hardening of special steels by nitrifying (with ammonia) gives a better and more lasting effect than hardening by forming a surface cementite layer.

Anti-knock Fuels. W. Altchidjian, *Comptes rendus*, Nov. 22, pp. 975-8. Certain fractions from Raguse petroleum, containing about 1 per cent S (8 to 10 per cent of sulpho-organic compounds) have an antiknock value about equivalent to 0.1 per cent tetraethyl lead.

Gelatine Plastics. Leon Bouvier, *Revue generale des matieres plastiques*, Nov., pp. 685ff. Phanorite is a plastic material made from completely desiccated gelatine. Its use overcomes the tenacious retaining of water in the interior of thick layers, which is a disadvantage of gelatine plastics made with water. It is useful for making handles, electrical goods, buttons, millinery ornaments, etc.

Carbon Monoxide. F. W. Burstall and S. J. Ellis. *Journal of the Society of Chemical Industry*, Jan. 28, pp. 35-6T. Illustrated description of a plant for production of CO from formic and sulphuric acids. A vitreosil reaction flask is used. The capacity as about 350 cu.ft. per six-hour day.

Chlorate Cells. J. Baumann. *Chemiker-Zeitung*, Feb. 2, pp. 81-2. Illustrated description of a concrete cell, with an arrangement of iron cathodes and graphite anodes permitting recovery of the evolved hydrogen. Other chlorate cell constructions are also described.

Cutting Rubber. A. P. Brintet. *Revue Generale des Matieres Plastiques*, Jan., pp. 50-4. Illustrated description of methods and machinery for cutting rubber in sheets, with particular emphasis on the Gargiulo machine.

Nitrating Cellulose. R. Gabillon. *Revue Generale des Matieres Plastiques*, Jan., pp. 15-27. Choice and evaluation of raw materials; nitrating acid; suitable conditions for the reaction. Illustrated with tables and curves.

Molded Insulation. Leon Bouvier. *Revue Generale des Matieres Plastiques*, Dec., pp. 773-9. A review of compositions used for the plastics from which molded insulation is made, and methods of making such insulation. The materials include bitumens (tar, asphalt, pitch), resins, waxes and synthetic resins, with fillers such as asbestos or organic fibers, kaolin, talc etc.

Tin Plate Corrosion. C. L. Mantell and E. S. Lincoln. *Canadian Chemistry and Metallurgy*, Feb., pp. 29-31. Foods may corrode tin cans by discoloration (sulphide formation), perforation (electrolytic action) or chemical etching of the tin. Heavier tinning helps against discoloration and perforation, but not against etching. Enamel nearly eliminates discoloration and etching, but accelerates perforation. Paper liners (Zn-free) are helpful in some instances, notably sea foods.

Aluminum Alloys. K. L. Meissner. *Zeitschrift für angewandte Chemie*, Jan. 13, pp. 61-2. Constructal 2 and Constructal 8 are described and compared with duralumin. The effect of various alloying metals is discussed with respect to tensile strength, elongation, hardness, etc.

Potash from Seawater. Enrico Niccoli, *Giornale di Chimica Industriale ed Applicata*, Dec., pp. 603-10. Some preliminary technical problems are discussed in connection with the Niccoli process of concentrating seawater by solar evaporation, and recovering salts of K and Mg. Illustrated with drawings, tables and concentration curves. The method looks promising.

Stoneware. Felix Singer. *Chemiker-Zeitung*, Jan. 26, pp. 61-2. Properties required for stoneware for different purposes; needed improvements in physical properties. Some special ceramic wares are discussed, e.g. insulators.

Glycerol Recovery. C. H. Keutgen. *Chemiker-Zeitung*, Jan. 26, pp. 62-4 and Feb. 2, pp. 82-4. The autoclave and the reagent methods of fat hydrolysis and glycerol recovery are discussed in some detail. The Krebitz and the fermentation processes are dismissed as having little or no practical application.

Condensed Water. Rene Escourrou. *Chimie et Industrie*, Jan., pp. 21-4. In pulp mills, electrolytic current detectors are used to detect leakage of acid cooking liquor (or any electrolyte) into condensed water from the steam used for heating the pulp. With this new aid, recovery of the condensed water of paper mills becomes profitable. Illustrated.

Wood Preservation. Carl G. Schwalbe. *Zeitschrift für angewandte Chemie*, Jan. 27, pp. 105-10. A simple apparatus is described and illustrated for extracting soluble matter from wood and impregnating with preservatives such as dinitrophenol, Na arsenite, $HgCl_2$, etc. New methods of making the amount of penetration visible are also described. Winter wood is more easily impregnated than trees cut in May.

Metallurgy in the High-Frequency Furnace. F. Koerber. *Zeitschrift für angewandte Chemie*, Jan. 27, p. 124. Recent small-scale experiments of the Kaiser Wilhelm Iron Research Institution show promise of great improvements in making electric furnace steels (soft steel, chrome steel, low carbon steels, etc.). Large-scale tests of these methods are next in order.

Sugar. C. A. Browne. *Chemistry and Industry*, Jan. 14, pp. 26-30. Some chemical aspects of the sugar industry, including relation of soil to crop; sources of chemical loss; refining equipment; colloidal impurities, and spontaneous decomposition of raw sugar.

High-Temperature Coking. L. H. Sensicle. *Journal of the Society of Chemical Industry*, Jan. 14, pp. 1-20T. The future of high-temperature coke in the light of its uses as a solid smokeless fuel for domestic and industrial heating; advances in production practice; the Koppers, Becker, Simplex and Otto (regenerative) types of oven; Sulzer cooling plant; methods of byproduct recovery; the gas industry as a producer; production of synthetic ammonia at coking plants; berginization of coal. Illustrated.

Methyl Chloride. S. R. Carter and N. J. L. Megson. *Journal of the Society of Chemical Industry*, Jan. 28, pp. 31-4T. Methyl alcohol and HCl do not react as vapors in the absence of a liquid phase. The reaction in the liquid state is governed by the law of mass action; it is retarded by water and by excess pressure of CH_3Cl or loss of CH_3OH by evaporation.

Filters. F. Egger. *Chemiker-Zeitung*, Feb. 5, p. 94. A comparison of the performance of rapid and slow filters in clarifying the city water supply of Stuttgart. Rapid filtration, with previous use of $Al_2(SO_4)_3$ as a clarifying agent, gives a greater improvement of the water and lessens the permanganate requirement. From a chemical standpoint, rapid filtration operates quite satisfactorily.

Drying Borax. M. A. Rakusin and D. A. Brodski. *Chemiker-Zeitung*, Feb. 5, pp. 95-6. Most of the water can be removed from borax decahydrate by heating with alcohol; but this method has no practical significance. By utilizing the heat of exhaust steam, the pentahydrate can be formed; and the stable monohydrate is easily made by using the waste heat of flue gas. Some of the methods used for dehydrating other crystalline salts are also applicable.

Solvent Recovery. *Bregeat. Chemiker-Zeitung*, Feb. 9, pp. 101-3. A chief objection to the cresol scrubbing process of solvent recovery has been the tendency of the cresol to resinify in use. Thus, a 50-ton lot, stored 3 months, lost 25 per cent by resinification. This difficulty has been overcome by adding tetralin or the like to the cresol; the viscosity increase is then much retarded.

Corrosion. *Zeitschrift für angewandte Chemie*, Jan. 20, pp. 96-103. Symposium papers at the 1926 Meeting of the Reichsausschuss für Metallschutz: Corrosion Research in England, M. Haas; Rust Damage and Protection Costs, W. Wiederholt; Stainless Steels, Strauss; Estimating Rate of Rusting and Rusting Tendency, Espe-

cially of Cr Steels, Duffek; Aluminum Corrosion, E. Maass; Nomenclature of Tars and Bitumens, Mallisson; Waters Which Attack Metals and Cement, Klut; Corrosion and Practical Boiler Operation, A. Splittgerber; Colloid Chemistry and Corrosion Research, Beck; Theory of Surface Coatings, A. Blom; Storch-Morawski Reaction, H. Wolff; Corrosion Protection by Coatings, O. Jäger; Standardization, K. Wuerth; Chemical Behavior and Over-Voltage of Metals, F. Liebreich; Cable Corrosion, O. Haehnel; Light Aircraft Alloy Corrosion, Rackwitz.

Corrosion. Hans L. Meurer. *Korrosion* (supplement to *Chemische Apparatur*), Jan. 25, pp. 1-2. Corrosion-resisting agents such as protective coatings; pigments and vehicles suitable for such coatings. Illustrated.

Ornamenting Aluminum. Leon Guillet. *Comptes rendus*, Jan. 17, pp. 134-6. When Al, or any alloy rich in Al, is dipped in a bath containing 5g. of Na fluosilicate, 10g. of crystalline $NiSO_4$ and 25g. of KNO_3 in 4 liters of water, a regular formation of colored lines, rapidly blackening in the bath, is observed. Designs can be produced by regulating the position and area of contact; for example, a drop of reagent on the metal gives radiating lines. The deposit is probably finely divided Ni, partially oxidized. It is not extremely tenacious, but is sufficiently so for many purposes.

Mixing and Masticating. M. Pailly. *Revue generale des colloides*, Nov., pp. 328-33. Illustrated description of equipment used for mixing and emulsifying liquids, suspending solids in liquids, masticating viscous or plastic materials and grinding cements, fertilizers and the like.

Mercurizing o-Cresol. Efisio Mameli. *Gazetta Chimica Italiana*, Dec., pp. 948-58. It is possible to mercurize o-cresol directly, with Hg acetate; but the reaction conditions differ from those developed by practical experience for other phenols, and must be carefully controlled. Several derivatives of mercurized o-cresol are described. Some of them may be of commercial interest as new medicinals.

Molded Insulation. Leon Bouvier. *Revue generale des matieres plastiques*, Dec., pp. 773, 775, 777-9. A description of the materials and manufacturing methods used in the production of molded electrical insulation from natural and artificial plastics. Among the artificial plastics are bakelite, cellite, cellon, thiolite, albertol and some of the casein plastics. Natural resins, bitumens and animal and mineral waxes are also discussed.

Carbide and Ferro-Silicon. Ernst Schlumberger. *Zeitschrift für angewandte Chemie*, Feb. 3, pp. 141-6. In the two leading industrial electrothermal processes (making CaC_2 and ferrosilicon) figures from actual operation were compared with the theoretical values for chemical balance and thermal effects. In the main, there was fairly good agreement. Observed discrepancies between theory and practice are traceable to such causes as improper furnace design, opening of the furnace during operation, etc.

Government Publications

Prices indicated are charged by the Superintendent of Documents, Washington, D. C., for pamphlets. Send cash or money order; stamps and personal checks not accepted. When no price is indicated pamphlet is free and should be ordered from Bureau responsible for issue.

Heavy Liquids for Mineralogical Analyses, by John D. Sullivan. Bureau of Mines Technical Paper 381. 10 cents.

Typical Methods and Devices for Handling Oil-Contaminated Water from Ships and Industrial Plants, by F. W. Lane, A. D. Bauer, H. F. Fisher, and P. N. Harding. Bureau of Mines Technical Paper 385. 15 cents.

The Motor Fuel Situation, by A. J. Kraemer. Bureau of Mines Circular No. 6015.

The Tin Situation from a Domestic Standpoint, by J. W. Furness. Bureau of Mines Circular 6018.

Consumption of Tin in the United States, 1925, by J. W. Furness. Bureau of Mines Circular 6019.

Mineral Production Statistics for 1925—Separate pamphlets from Bureau of Mines on: Potash, by A. T. Coons; Fullers Earth, by Jefferson Middleton; Stone, by A. T. Coons. 5 cents each.

Mineral Production statistics for 1926—preliminary mimeographed statement from Bureau of Mines on: Sulphur and Pyrites in 1926.

Gas-Measuring Instruments. Bureau of Standards Circular 309. 40 cents.

Production statistics from 1925 Census of Manufactures in preliminary mimeographed form for: Pig Iron and Ferroalloys; Paints and Varnishes; Concrete Products.

Germany and the Aluminum Cartel, by Consul Hamilton C. Claiborne, Frankfort-on-Main, Germany. Bureau of Foreign and Domestic Commerce Special Circular No. 520 of the Minerals Division.

Developed Water Power in the United States January 1, 1927. A mimeographed summary prepared by the Geological Survey and by the Federal Power Commission.

Portable Methane Detectors — Requirements for Permissibility Tests Made, and Fees Charged. Bureau of Mines Schedule 8B. 5 cents.

Oil-Field Emulsions, by D. B. Dow. Bureau of Mines, Bulletin 250. 25 cents.

The Bowie-Gavin Process: Its application to the cracking of tars and heavy oils, also to the recovery of oil from oil-soaked sands or shales, or from oil shales, by C. P. Bowie. Bureau of Mines, Technical Paper 370. 15 cents.

Effects of the Corona Discharge on Petroleum, by J. J. Jakosky. Bureau of Mines, Technical Paper 375. 10 cents.

Petroleum in 1924, by G. B. Richardson and A. T. Coons. Bureau of Mines pamphlet. 15 cents.

The Meaning of Specifications for Gasoline and Kerosene, by A. J. Kraemer. Bureau of Mines, Circular 6013.

Analyses of Panhandle and Big Lake, Texas, Crude Oils, by N. A. C. Smith. Bureau of Mines, Circular 6014.

Survey of Petroleum Pipe Lines and Storage Capacity for Crude Oil and Refined Products, by G. R. Hopkins and A. T. Coons. Bureau of Mines, Circular 6016.

Railroad Fuel Oil Consumption, by E. B. Swanson. Bureau of Mines, Circular 6017.

Mineral Production Statistics for 1925—Separate pamphlets from Bureau of Mines on: Manganese and Manganiferous Ores, by J. W. Furness, 10 cents; Secondary Metals, by J. P. Dunlop, 5 cents; Lead, by J. A. Stader and A. Stoll, 5 cents; Chromite, by J. W. Furness, 5 cents; Iron Ore, Pig Iron and Steel, by Hubert W. Davis, 10 cents; Gold, Silver and Copper in South Dakota and Wyoming, by Charles W. Henderson; Lead and Zinc Pigments and Salts, by J. A. Stader and A. Stoll; Gypsum, by Jefferson Middleton; Mercury, by J. W. Furness; Platinum and Allied Metals by James M. Hill; Barite and Barium Compounds by A. Stoll and R. M. Santmyers; Lime, by A. T. Coons; Talc and Soapstone, by Blanche H. Stoddard; Natural Gas, by G. R. Hopkins; Phosphate Rock, by W. M. Weigel and B. H. Stoddard; Mica, by W. M. Myers and Blanche H. Stoddard; Abrasive Materials, by Frank J. Katz; Natural-Gas Gasoline, by G. R. Hopkins; Slate by A. T. Coons; Magnesium and Its Compounds, by J. M. Dill; Clay, by Jefferson Middleton; Asbestos, by Blanche H. Stoddard; Salt, Bromine and Calcium Chloride, by A. T. Coons; Feldspar, by Jefferson Middleton, 5 cents each.

Mineral Production Statistics for 1926 — Preliminary Mimeographed statements from Bureau of Mines on: Copper, Sales of Lime; Manganese; Lead and Zinc; Slate.

Production Statistics from 1925 Census of Manufacturers in preliminary mimeographed form for: Nitrogen and Fixed Nitrogen Compounds; Compressed and Liquefied Gases; Sulphuric, Nitric and Mixed Acids; Lime; Sodium Compounds; Potassium Compounds; Acids; Petroleum Refining; Cement; Aluminum Manufacture; Cast-Iron Pipe and Fittings; Tanning Materials, Natural Dyestuffs, Mordants and Assistants, and Sizes; Tin Cans and Other Tinware; Paper and Wood Pulp; Wood Distillation and Charcoal Manufacture.

Miscellaneous Publications

The Anodic Oxidation of Aluminum and Its Alloys as a Protection Against Corrosion. Department of Scientific and Industrial Research (British). Available through British Library of Information, 8th Floor, 44 Whitehall Street, New York City. 1s. 3d. net.

Minutes of the Special Convention of the Fertilizer Industry held at Washington, D. C., Jan. 10, 1927, under the auspices of The National Fertilizer Association; also, *The Fertilizer Review*, Vol. 1 (Jan.-Dec., 1926). Published by The National Fertilizer Association, 616 Investment Building, Washington, D. C.

Sixth Annual Report of the British Sulphate of Ammonia Federation, Ltd. Available from the headquarters of the Federation, London.

The Plant Notebook

An Exchange for Operating Men

Acid Quality Suffers in Hot Weather

Users of sulphuric acid who require a high quality product the year round can well concern themselves with the question of iron contamination during hot weather. The experience of one large acid user indicates that the regular source of supply is satisfactory during cold weather, but during hot weather contains iron above 0.01 per cent, which is the upper permissible limit for his use.

A careful study of the source of contamination of acid which apparently was of suitable quality when it left the manufacturers indicated that particularly during hot waves the rate of iron contamination in tank cars was greatly accelerated. Thus acid that in normal weather conditions would reach its destination satisfactorily was, under these extremes of weather, sufficiently contaminated to cause serious difficulty in use. No remedy except choice of weather for shipping has yet been discovered to eliminate this complication.

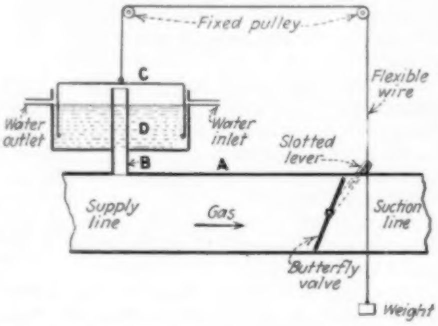
Lightweight Pitcher for Handling Iron Perchloride

By W. J. Risley, Jr.
North Glenside, Pa.

Copper cylinders for printing such work as rotogravure are etched with iron perchloride. This reagent has a severe action on practically all metals and is consequently handled only in glass or stoneware containers. During the etching, the perchloride is poured over the slowly revolving cylinder from a glass or stoneware pitcher, usually of about 2 quarts capacity. Such pitchers are easily broken, heavy and clumsy to handle.

The writer attempted to find some light material from which these pitchers could be made, one that would withstand the action of the perchloride and also reduce the replacement of broken units necessary when glass or stoneware were used. No metal suitable for such use seemed to be able to withstand the corrosive action.

Finally it was decided to have an ordinary aluminum water pitcher covered with soft rubber by the "Vulcalock" process. Such a pitcher has now been in use for several months and shows no sign of breakage down. Besides eliminating breaking entirely, this pitcher has several other advantages. It is very light and easy to handle. If accidentally struck against the copper cylinder, the soft rubber obviates any damage. The design of the pitcher is now being modified to make it more suitable for the process and to render the application of the rubber covering more convenient.



Automatic Pressure Regulator for Gas Lines

Automatic Pressure Regulator

Where gas is drawn continuously from two separate sources, both connected to the suction side of a compressor or booster, a pressure regulator or balancing valves are required. An example of such a process is the manufacture of sodium bicarbonate by the carbonation of a solution. Gases are drawn from calcining furnaces and lime kilns into a compressor where the mixture is compressed and forced into the carbonating system. Variation in the amount of gas available at either source necessitates immediate regulation and a corresponding change in the suction line valves.

Such regulation may be made automatic by means of an arrangement shown in the accompanying sketch. The pipe *B*, attached to the gas line *A*, runs almost to the top of the bell *C*, so that it clears the water or other sealing liquid *D*, in all cases. This liquid is kept at a constant level.

The diameter of the bell is such as to give the desired sensitivity to the apparatus. The bell is balanced by means of the counterweight *E*, to which weights may be added or removed as desired. If the bell is large, it may be slightly weighted at the lower edge to hold it in an upright position.

Attached to the flexible wire or rope is a lever that moves the butterfly valve in the gas line. When the pressure in one of the supply lines is increased due to an increase in the gas supply at the source, the bell rises. This opens the butterfly valve, allowing the compressor to take more gas from this line and maintains a constant draft.

Economies Obtained in Power Generation

By using electricity, generated on the premises, instead of a number of small reciprocating engines, for driving plant equipment and for lighting, the Whitall Tatum Company shows, by a recent analysis, a net annual saving of $10,429.42.

In 1920 the plant power was supplied by 22 small reciprocating engines and an investigation was made to determine a better method of drive. As a result, a 300-kilowatt turbine generator was installed in 1921, together with motors to handle the factory load. Six months later a second generating unit was installed for the purpose of using one prime mover as a spare, power being needed at all times.

The turbines are four stage machines each rated 3,600 r.p.m., 80 lb. pressure, and operated condensing. The generators are each rated 375 kva., 480 volts, 80 per cent power factor.

A recent analysis shows that the annual fixed cost of operating the two generating units is $5,785.23, or $15.85 per average day. When the cost of oil, steam, labor, etc., is added, the total cost per 24-hour day is $52.96, or a total cost per generated kilowatt-hour of $.0327.

By comparing the coal consumption with that of the previous installation, a saving of 5.73 tons per day is shown, or $11,294.10 per year. The daily saving in labor charges is $5.37, or $1,960.05 per year.

As against the present fixed cost of the turbine installation ($5,785.23), the old engines had a fixed cost of $2,960.50. Thus the present net fixed cost is $2,824.73. This figure, when subtracted from the total savings of coal and labor, shows a net saving of $10,429.42 per year, or a net annual return on the investment in generating equipment of 23.2 per cent. It is estimated that the entire installation will pay for itself in 4⅓ years.

Novel Screw Conveyor Reduces Bearing Troubles

Maintenance of bearings on long screw conveyors is a fruitful cause of difficulty and often of plant interruption, especially when materials of an abrasive nature are being handled. A scheme to eliminate this sort of difficulty has been utilized successfully in several plants, consisting of a staggered type of conveyor.

In this new type, instead of a single long screw within a single housing, there are two parallel shafts on each of which there are one or more sections of screw. The material, therefore, is advanced a short distance by one unit and then is forced into the adjoining parallel unit for the next forward movement. The screw within any single unit is thus made short enough so that all of the bearings can be placed outside of the housing. No material comes in contact with the bearings. The limit of length depends solely upon the number and length of screw units which it is desired to use, and the number of passes back and forth.

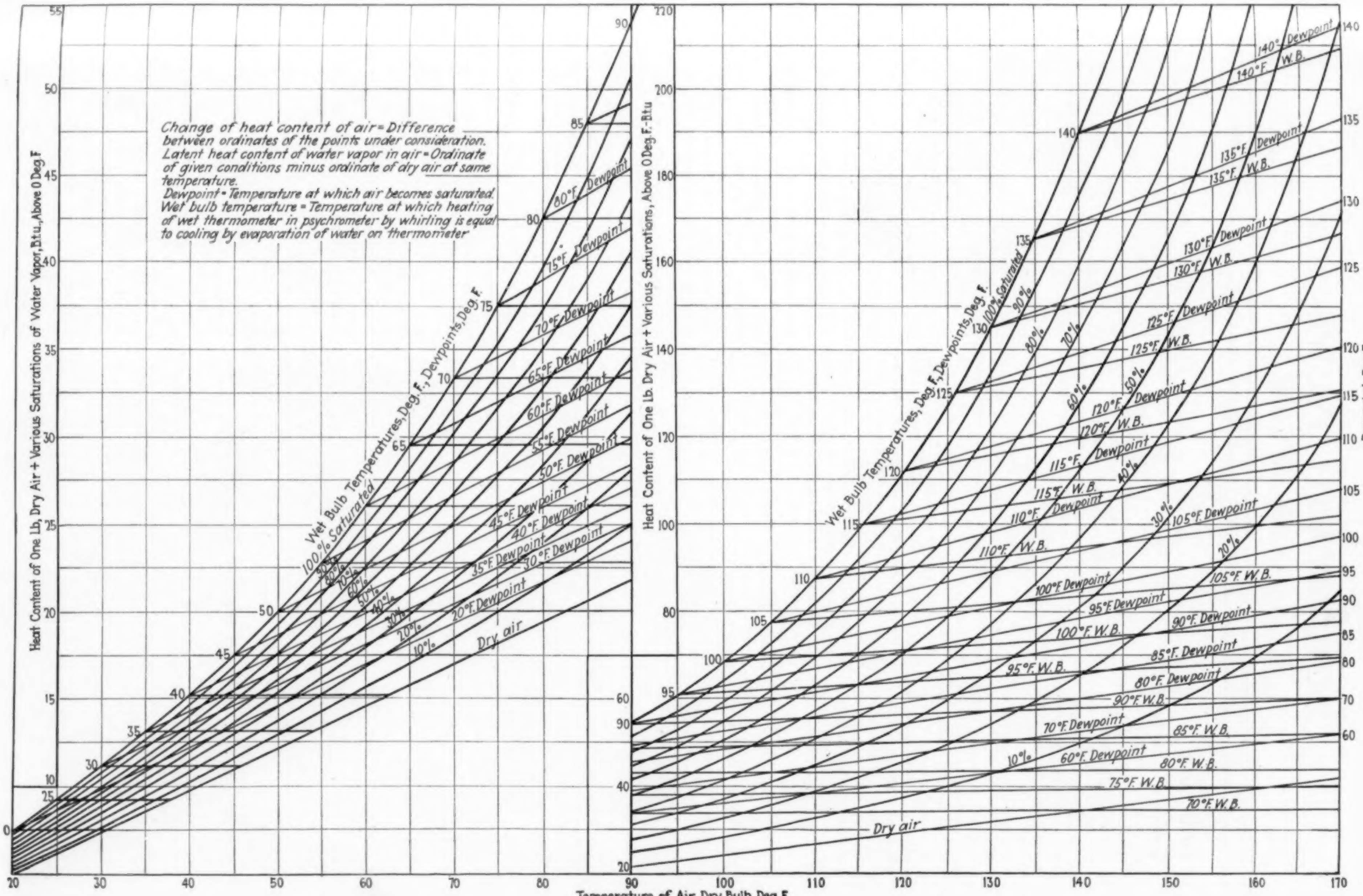


Chart Giving Thermal Properties of Air with Varying Moisture Content—By L. G. Jones, Baltimore, Md.

This chart is useful in problems involving changes in saturation and temperature of air. The properties included are heat content, dewpoint, saturation or humidity, wet and dry bulb temperatures, with the dry bulb temperature used as the independent variable. Some of the information that can be obtained readily from the chart is: (a), change in heat content, in B.t.u. per lb. of air, for changes in temperature and moisture content; (b), changes in dewpoint, for varying wet bulb depressions, heat content and saturation; (c), change in relative humidity for addition or removal of heat, or change in wet or dry bulb temperature; (d), change in wet bulb depression caused by heating or cooling air, with the accompanying total heat change.

Equipment News
From Maker and User

Flow Indicator

An indicating flowmeter has recently been placed on the market by Morey, Jones & Lovell, Los Angeles, Calif., called the MJL meter. This meter is suitable for measuring the flow in any process and can be used with water, oils, syrups, gases, steam or other fluids. It can be installed at the point of flow or remotely.

This indicator operates by means of an orifice inserted in the line of flow, either between flanges or in a special fitting. The pressure differential on the two sides of this orifice acts on the mercury in a U-tube, one leg of which is a glass tube, and serves as an indicator. A ball floats on top of the mercury column and any undue rise of the column causes the ball to seat in a socket, thus preventing the mercury from blowing over. Water seals or condensing reservoirs are inserted when needed.

Electrically Operated Valve

An electrically operated valve, for the remote control of fluid flow has recently been put on the market by Dravo-Doyle Co., Pittsburgh, Pa. This valve, which is called the "Presto," is a 12 in. horizontal valve for use with heads of 80 ft. or less and is operated by a 230-volt, d.c. solenoid. The normal position is closed and the application of current to the solenoid holds it in the open position. In case of interruption to the current supply of the solenoid, either through the operation of other equipment or through push button control, the valve automatically closes by gravity. Upon reapplication of the current to the solenoid, the valve automatically opens.

The valve is of the double seat, semibalanced type, the water entering between the disks. The upper seat being necessarily larger than the lower, when the valve is closed there is an unbalanced pressure equal to the difference in the area between the upper and lower disks which tends to open it. Sufficient counterweight is applied to the valve so that this weight added to the weight of the moving valve parts will overcome the unbalanced pressure and hold the valve to its seat with a minimum of leakage.

All valve parts except the body are of bronze. The seats are built in a single bronze casting with a slight taper which is inserted in the body with a ground fit and prevented from moving by four bolts. The disks are connected by four legs and have sufficient strength to resist the water pressure tending to push them apart. These legs serve also as guides. The stem is held to the disks by a nut with a loose fit so that the valve may seat irrespective of variation in stem position caused by stuffing box adjustment.

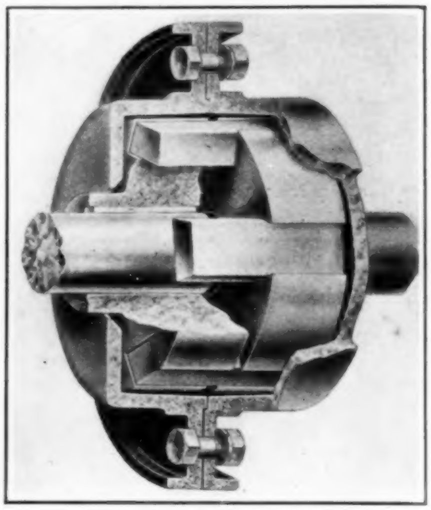
The speed of closing is regulated by a dashpot. The oil in this dashpot must pass upwards between the plunger and the walls and the clearance is regulated to give a closing time of approximately five seconds. This time is sufficient to avoided water hammer on the piping.

The solenoid has a stroke of 1¾ in. and uses 3,500 watts or less to open with 870 watts to hold open.

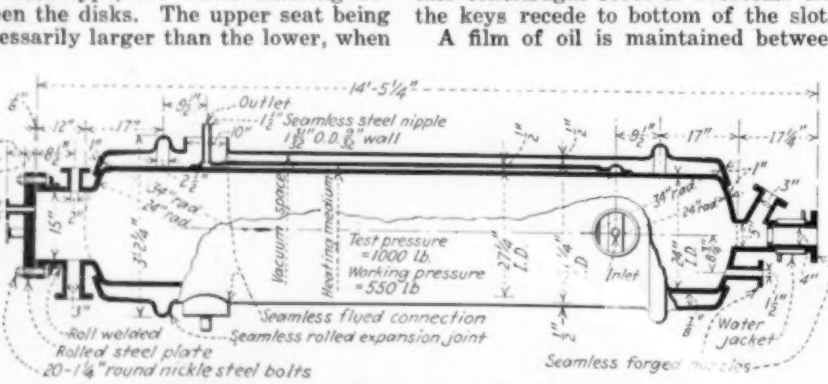
Flexible Coupling

W. H. Nicholson & Co., Wilkes-Barre, Pa., have developed a flexible coupling a sectional view of which is shown in the accompanying illustration. This coupling is made of steel throughout. Shaft misalignment is taken care of by the loosely fitting floating keys with beveled sides, shown in the illustration. When revolving, these keys are thrown out in the slots by centrifugal force. When a torsional load is encountered, this centrifugal force is overcome and the keys recede to bottom of the slots.

A film of oil is maintained between the keys and slots at all times, allowing a free lateral float of the coupling hubs. In case of wear, these dovetail keys can readily be procured from any machine shop. The strength of the keys is so much in excess of the shaft that it is not necessary to specify horsepower or speed when ordering, as any given size of coupling will withstand a greater load than the shaft upon which it is used. Oil is retained in the coupling by a gasket between the flanges. These couplings are available for all sizes of shafts.



All-Steel Flexible Coupling



All-Welded, High-Pressure, Jacketed Autoclave

This autoclave is operated at 550 lb. per sq.in. and was tested to 1,000 lb. per sq.in. It is roll-welded throughout by the Rowland process by the American Welding Co. There are two jackets, the inner for the heating medium; the outer, with seamless, rolled expansion joints, providing a space exhaused to a high vacuum and acting as an insulating jacket

Electric Heating Element

An electric heating element of a nonmetallic nature has recently been introduced into the United States by the Morgan Crucible Co., Ltd., of England, who are represented in this country by the Morganite Brush Co., Inc., 3302 Anable Ave., Long Island City, N. Y.

The element is made of the "Morganite" resistor material, which is of a ceramic nature and can be made up in a wide variety of sizes and shapes. The rectangular slab form is considered most adaptable to industrial furnace design as it provides an unbroken heating surface, insuring even heat emission. These slab elements are available in sizes up to 7 ft. x 2 ft. x 1 in.

These elements are suitable for a heating range within the limits of 750 to 1,350 deg. C. They can be used below 750 and above 1,350 up to 1,400 deg. C. where long life is not of importance. Deterioration of the resistor material is impeded by means of a vitreous coating which surrounds it. Operating continuously at temperatures between 750 and 1,350 deg. C., deterioration is said to be slow and the slight resistance rise which it occa-

sions is compensated for by voltage regulation to maintain the desired loading continuously. Under intermittent operation the resistance rise is more rapid but can be compensated for by simple voltage regulation. The life under continuous operation is 8 to 10 weeks, while with intermittent operation it is about 30 heats.

This life is comparatively short as against that of a metallic resistor. But this short life is said to be more than counterbalanced by the much lower cost of the elements and the ease and simplicity of renewing them.

These elements are of low ohmic resistance and operate at voltages ranging from 25 to 60 volts. The permissible loading per square foot of wall or roof area is high because the heat is generated uniformly over the entire surface of the heater and the working temperature may be as high as 1,350 deg. C. This loading depends solely upon the rate of heat transfer from the element to the furnace charge.

It is claimed that, because of the high permissible loading, the rate of heating with this element is high when compared with other types of elements and consequently a higher rate of output is obtained. Because of these facts, the efficiency of a furnace equipped with these elements is said to be high since the radiation loss in terms of kilowatts is small compared to the total input. The avoidance of multi-terminals and contacts and the consequent reduction in terminal and contact losses also makes for high efficiency. Temperature distribution within a furnace can be made exceedingly uniform with these elements, since they can be mounted over the entire face of the walls and roof, as desired.

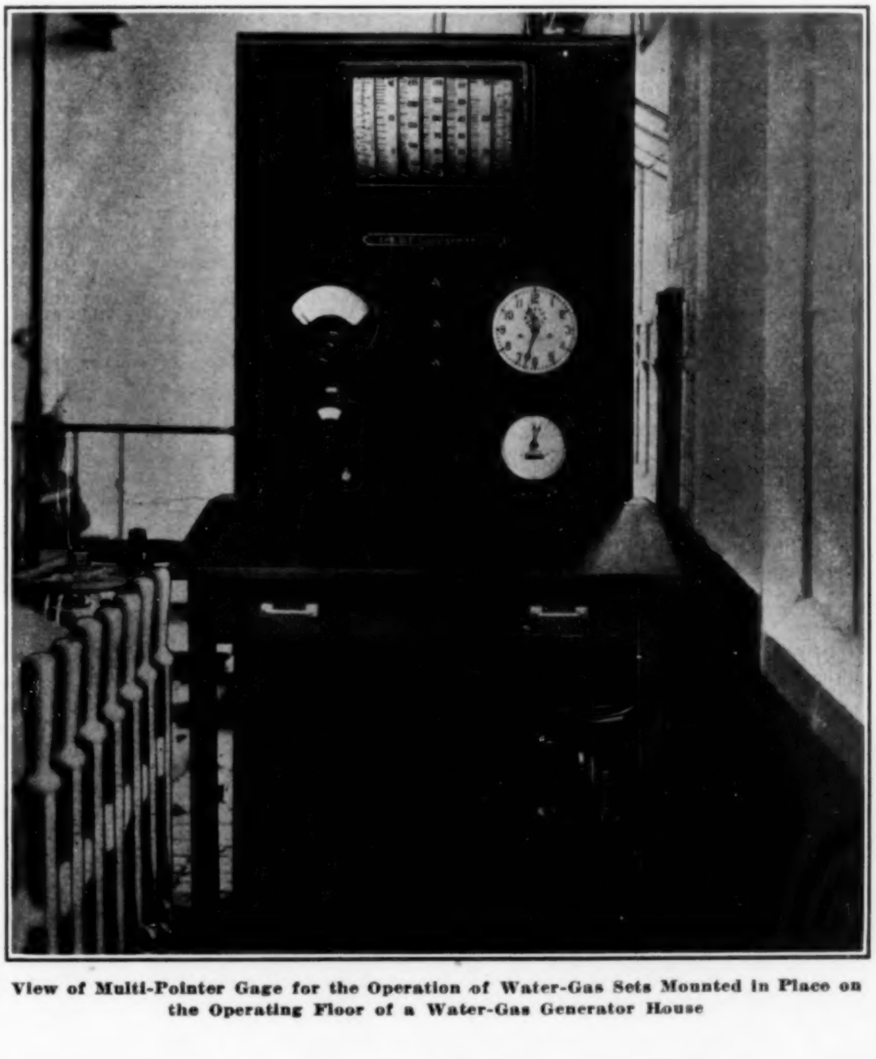
Alternating current supply is preferable for the operation of these heating elements so that the necessary voltage range can be obtained by means of a simple and inexpensive transformer. Each element is provided with a single phase transformer and control gear. The transformer should be designed with the secondary circuit in two sections for series or parallel connection. Tappings should be provided in the primary windings so that a voltage range of 25 to 50 volts with several intermediate voltages is available for each of the secondary sections. This will give an extreme range of 25 to 100 volts. Full kva. output should be available at any of the secondary voltages.

In a kiln used for glost firing of cups, saucers and other small ware, now operated for over two years at the works of the Akt. Gustavsberg Fabriks Intressenter, Sweden, the following performance has been obtained: The kiln is a 60-ft. tunnel kiln employing two 7 x 2 ft. heating elements placed in the roof. Trucks 5 x 1 ft. in area are pushed through on double tracks in opposite directions for heat recuperation. Headroom of 4 to 6 in. is provided above the trucks for a single layer of ware. A load of 70 kw. is used when trucks are pushed in from both ends with a speed of 30 ft. per hour. The output is about 50 dozen cups or 100 lb. of ware per hour. With a steady input of 70 kw. and a cost of 1 cent per kw.-hr., it costs 1.4 cents to fire 1 dozen cups and 0.7 cents for 1 lb. of ware. The renewal cost for the elements is about $300, which, with a life of eight weeks amounts to about 0.4 cents per dozen cups or 0.2 cents per lb. of ware. In addition, it is claimed that the cost of the electric energy is less than the saving realized from reduced rejections and the cost of the renewal of elements is less than the cost of saggers, which are not needed with the electrically heated kiln.

Gas Generator Meters

A multi-pointer gage for indicating accurately all the quantities that must be known for the proper operation of a water-gas set, has recently been developed by the Bailey Meter Co., Cleveland, Ohio. The accompanying photograph shows one of these meters with an appropriate panel on which are also mounted other instruments necessary in the operation of the set. These multi-pointer gages can be arranged to indicate anywhere from 1 to 12 different quantities including such items as draft, pressure, flow, temperature, speed and other factors of this nature. In the example shown, the left-hand indicator shows the amount of air to the generator. The next column gives the steam pressure, the next the oil pressure, the fourth gives the water pressure, the fifth gives the ash-pit pressure, the sixth gives the outlet-water pressure, while the last column gives the flow of air to the carburetor. Other quantities can be indicated either in addition to or in place of any of those that are given on the instruments shown.

The construction and operation of these meters is developed along the same lines as used in other Bailey meters such as the well-known "Boiler Meter." Several of these gages for water-gas sets have already been installed and it is stated by the manufacturer that their operation has been satisfactory to the users.



View of Multi-Pointer Gage for the Operation of Water-Gas Sets Mounted in Place on the Operating Floor of a Water-Gas Generator House

Variable Speed Drive

A new variable speed drive has recently been placed on the market by the P.I.V. Gear Syndicate, Ltd., 7 Princes Street, Westminster, S. W. 1, London, England. This concern expects soon to establish a branch in the United States and market the drive there. This drive is called the P.I.V. (positive infinitely variable) gear.

With this drive it is said to be possible to obtain an infinity of speed variations on a driven shaft, at any centers, from a driving shaft running at constant speed, with positive transmission and control by a single lever. This permits the ordinary a.c. motor to be used where speed variations are desired, without the need of any regulating device.

The design of the ordinary standard type of this drive is shown in Fig. 1.

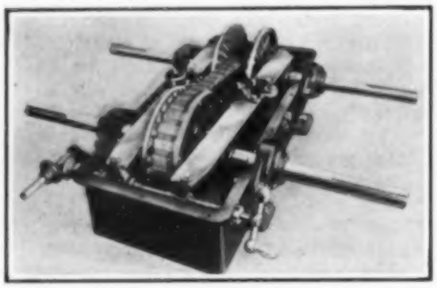


Fig. 1—Positive Infinitely Variable Speed Drive

This view shows the standard form of this drive, with the top of casing removed to expose the chain and pulleys

It consists of a pair of pulleys which are constructed of opposed conical disks that can be caused to vary in the distance between their faces. Each of these pulleys is mounted on a shaft and between them runs a chain belt of special design, engaging in a positive manner the teeth on the conical disks. As the disks are moved along the shaft, nearer together or farther apart, by the control lever, the chain rises or sinks in the space between, thus changing the speed ratio.

The chain is made up of links, each with a longitudinal slot in it, which is filled tightly with upright thin steel plates free to move transversely. The ends of these plates are engaged by the ribs on the conical disks. Tests have shown that this arrangement has a power transmission efficiency up to 95 per cent while running smoothly and noiselessly.

Fig. 1 shows the drive arranged for enclosure in a dust-proof casing. Fig. 2 shows an open drive from a motor with a longer distance between centers. In this figure is shown an a.c. motor running at 1,000 r.p.m., with a driven shaft that can be varied from 250 to 500 r.p.m. by turning the wheel at the end of the motor shaft.

Another modification of this drive allows a constantly varying speed being given to a driven shaft within any predetermined range. In one example, the driving shaft runs at a steady speed of 300 r.p.m. transmitting 3 to 4 hp., and the driven shaft, starting at 330 r.p.m. gradually reduces to 270 r.p.m. during a fifty minute interval. The speed then returns to 330 r.p.m. in a period not exceeding four seconds and the cycle is repeated automatically. This modification is used in rayon spinning, but can undoubtedly be used to advantage elsewhere.

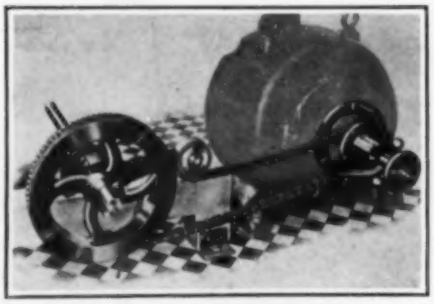
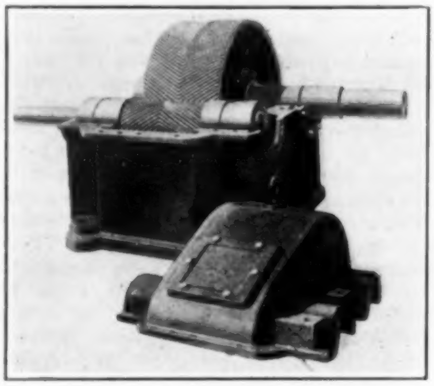


Fig. 2—Variable Drive Arranged for Direct Connection to Motor

This drive is connected to an a.c. motor running at 1,000 r.p.m. and permits speeds at the driven shaft ranging from 250 to 300 r.p.m.

Speed Reducer

D. O. James Mfg. Co., Chicago, Ill., have recently brought out a line of continuous-tooth, herringbone speed reducers, of the double helical type, as shown in the accompanying illustration. These reducers are manufactured for ratio from 2 to 1, to 150 to 1 and for loads from 2 to 200 hp. They are of heavy, rugged construction and are particularly designed for drives in such industries as sugar, rubber, paper, steel, chemical and glass manufacture.



Double Helical Gear Speed Reducers

Manufacturers' Latest Publications

Boston Gear Works Sales Co., Norfolk Downs, Mass.—Bulletin C1-27—A catalog entitled "Industrial Speed Reduction," giving description and specifications of standard sizes of speed reducers.

B. F. Goodrich Rubber Co., Akron, Ohio—Bulletin 9585—A booklet on the use of "Linerite" rubber linings for batch mills in the ceramic and chemical industries.

Irving Iron Works Co., Long Island City, N. Y.—A new folder on open steel flooring and "Subway" gratings.

Central Steel Co., Massillon, Ohio—A catalog of "Agathon" alloy steels of various types.

Automatic & Electric Furnaces, Ltd., 173 Farringdon Road, E. C. 1, London, England—Bulletin No. 37—A bulletin discussing theory and practice in steel hardening.

Hardinge Co., York, Pa.—Bulletin No. 24—A booklet entitled "Operation Notes for Ball Mill Users," being a presentation of methods for improving the operation of ball mills.

Adam Hilger, Ltd., 24 Rochester Place, Camden Road, N. W. 1, London, England—A leaflet describing the "Guild" trichromatic colorimeter.

Patterson Foundry & Machine Co., East Liverpool, Ohio—A new bulletin describing the design and operation of ball and tube mills made by this company.

New Departure Mfg. Co., Bristol, Conn.—Bulletin No. 174FE—A bulletin on the application of ball bearings to portable equipment such as chipping tools.

General Electric Co., Schenectady, N. Y.—GEA-571—A bulletin describing arc welding accessories such as shields, helmets and electrode holders.

U. S. Stoneware Co., Akron, Ohio—Bulletin No. 501—A bulletin describing laboratory sinks, pipe and fittings of acid-proof stoneware.

Lamson Co., Syracuse, N. Y.—A folder on the use of gravity roller conveyors.

Raymond Bros. Impact Pulverizer Co., Chicago, Ill.—Catalog No. 19—A new catalog of Raymond pulverizing and grinding mills, with a discussion of pulverizing problems and a description of a complete air separating equipment.

Philadelphia Quartz Co., Philadelphia, Pa.—A bulletin discussing the use of silicate of soda in paper making, its action and the methods of employing it.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.—A folder describing three new types of electric furnaces for heat treating.

Taylor Instrument Companies, Rochester, N. Y.—A new, loose-leaf, general catalog of thermometers and other instruments for indicating, recording and controlling temperature and pressure.

Philip Carey Co., Cincinnati, Ohio—Three new publications as follows: a reprint of an article by L. E. Whitaker on, "Choosing Economical Thickness of Heat Insulation"; a leaflet on the use of power by this company for manufacturing purposes; and a bulletin on "Multi-Ply" asbestos insulation.

American Schaeffer & Budenberg Corporation, 338 Berry St., Brooklyn, N. Y.—Catalog 500—A catalog covering all types of stationary and portable recording and indicating tachometers.

Orville Simpson Co., Cincinnati, Ohio—Bulletin No. 19—A new catalog of "Rotex" sifters and screens, describing their operation and application.

Pfaudler Co., Rochester, N. Y.—Catalog 675—Catalog of the 1927 series of standard glass-lined chemical plant equipment.

Chas. Cory & Son, Inc., 183 Varick St., New York, N. Y.—Bulletin No. 60-29-A—A catalog of annunciators, bells, buzzers and other signal equipment.

Duriron Co., Dayton, Ohio—Price List No. 11—New price list of Duriron products.

Standard Conveyor Co., North St. Paul, Minn.—Bulletin showing applications of gravity roller conveyors. Also bulletin showing applications of portable stacking conveyors.

Sturtevant Mill Co., Harrison Square, Boston, Mass.—Catalog No. 87—New catalog of crushing, grinding, screening, air separating, elevating, conveying, mixing, weighing and sacking machinery.

United Filters Corporation, Hazleton, Pa.—Bulletin No. 130—A bulletin describing the design and operation of the "American" continuous filter.

U. S. Stoneware Co., 50 Church St., New York City—Bulletin No. 276—A new bullescribing X-ray developing tanks, laboratory jars and other equipment made of acid-proof chemical stoneware.

The Electric Controller & Mfg. Co., Cleveland, Ohio—Two new bulletins as follows: Bulletin 1037-C, describing Type B limit stops for alternating and direct current motors; bulletin 1042-F, describing automatic compensators for 110 to 550 volt a.c. squirrel cage and synchronous motors.

Sarco Co., Inc., 183 Madison Ave., New York, N. Y.—A bulletin entitled "The Widening Field of Automatic Temperature Control," by Joseph A. Maguire, discussing applications of temperature controllers.

O. Zernickow Co., 15 Park Row, New York, N. Y.—A bulletin of tachometers, including a new line of stationary instruments with 6 in. dials.

Hills-McCanna Co., 2025 Elston Ave., Chicago, Ill.—A new illustrated folder describing positive delivery proportioning pumps for chemical plants.

Corning Glass Works, Corning, N. Y.—A catalog of industrial glass products made from "Pyrex" glass.

George P. Reintjes Co., Kansas City, Mo.—A folder describing flexible arch tile for use in furnace construction.

Aluminum Co. of America, Pittsburgh, Pa.—A new edition of the aluminum paint book, revised, and combining the material formerly in this book with that in the aluminum paint manual.

Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa.—Bulletin No. 496—This bulletin No. 4, in the power plant series, deals with surface condenser leakage and boiler water concentration.

American Brass Co., Waterbury, Conn.—Publication E1—A catalog on "Everdur" manganese-silicon bronze, discussing its general properties and giving suggestions for melting and pouring.

Adam Hilger, Ltd., 24 Rochester Place, Camden Road, London, N. W. 1, England—A bulletin discussing developments in connection with Hilger instruments, covering the year ending June 30, 1926.

New Departure Mfg. Co., Bristol, Conn.—Bulletin No. 176 FE—A bulletin discussing the application of ball bearings to centrifugal dye extractors.

Foote Bros. Gear & Machine Co., 215 N. Curtis St., Chicago, Ill.—Catalog 300—A catalog of specifications and applications of worm gear speed reducers.

Norton Co., Worcester, Mass.—A bulletin on the use of Norton products for grinding car wheels.

Lee B. Mettler Co., Los Angeles, Calif.—New catalog of the various types of "entrained combustion" gas burners made by this concern, illustrating their application.

United Cork Companies, Lyndhurst, N. J.—Catalog of "Crescent" corkboard insulation for reducing heat losses and preventing condensation in industrial plants.

Nashville Industrial Corporation, Old Hickory, Tenn.—Bulletin No. 27—Catalog of second-hand steam locomotives, storage battery locomotives, gasoline locomotives, cars and rail.

Brown Instrument Co., Philadelphia, Pa.—Catalog No. 75—Catalog of recording pressure and vacuum gages and their applications.

Patents Issued Feb. 1 to March 1, 1927

Paper, Pulp and Sugar

Tinted Burnished Metal-Coated Paper. Gerhardt E. Grimm, Springfield, Mass., assignor to Westfield River Paper Company, Russell, Mass.—1,617,946.

Coated Paper and Process of Making the Same. Gerhardt E. Grimm, Springfield, Mass., assignor to Westfield River Paper Company, Russell, Mass.—1,617,945.

Method and Apparatus for Making Paper Having the Appearance of Handmade Paper. James H. A. Armstrong, Holyoke, Mass., assignor to American Writing Paper Company.—1,616,211.

Process of Making Multiply Waterproof Sheets. Lester Kirschbraun, Chicago, Ill. —1,616,901.

Process and Apparatus for Making Paper. Lester Kirschbraun, Chicago, Ill.—1,616,903.

Process and Apparatus for the Production of Wood Pulp. Christian Jonathan Sternkopf, Rittersgrun, Germany.—1,619,004.

Process and Device for Drying Paper and the Like Fibrous Webs. Eduard v. Asten, Eupen, Belgium.—1,615,210.

Paper-Making Machine. Thomas Terrence Rogan and Edward B. Wright, Fitchburg, Mass.—1,617,767.

Cylinder for Paper-Pulp Machines. Nathan H. Bergstrom, Neenah, Wis.—1,619,052.

Method for Cooling and Utilizing the Heat Content of Relief Gas from Sulphite Digesters. George A. Richter, Berlin, N. H., assignor to Brown Company, Berlin, N. H.—1,616,703.

Process for Producing Pure Sugar Liquors. Carl Fredrik Kullgren and Sven Gustaf Lind, Stockholm, Sweden.—1,616,131.

Process of Manufacturing White Sugar. William F. R. Murrie, Hershey, Pa.—1,615,846.

Rubber and Synthetic Plastics

Process for Vulcanizing Rubber and Products Obtained Thereby. Morris L. Weiss, Newark, N. J., assignors to Dovan Chemical Corporation, New York, N. Y.—1,616,936.

Vulcanization of Rubber and Method of Producing Same. Lorin B. Sebrell, Akron, Ohio, assignor to The Goodyear Tire & Rubber Company, Akron, Ohio.—1,616,994.

Vulcanization of Rubber and the Product Thereof. Walter Kropp, Elberfeld, near Cologne-on-the-Rhine, Germany, assignor to I. G. Farbenindustrie Aktiengesellschaft, Frankfort-on-the-Main, Germany.—1,616,378.

Method of Vulcanizing Rubber and the Like. Thomas W. Miller, Ashland, Ohio, assignor to The Faultless Rubber Company, Ashland, Ohio.—1,617,411.

Process and Apparatus for Vulcanizing Articles. John L. G. Dykes, Chicago, Ill.—1,616,954.

Composite Product and Method of Making the Same. William C. Geer, Akron, Ohio, assignor to The B. F. Goodrich Company, New York, N. Y.—1,617,588.

Laminated Material and Method of Making the Same. William C. Geer, Akron, Ohio, assignor to The B. F. Goodrich Company, New York, N. Y.—1,617,707.

Preparing Rubber-Coated Fabric. Colin Macbeth, Four Oaks, and Wallace John Dexter, Erdington, Birmingham, England, assignors to Dunlop Tire and Rubber Corporation of America, Buffalo, N. Y.—1,617,340.

Process of Combining Cellulose and Rubber. Sidney A. Ogden, Los Angeles, Calif. —1,617,495.

Synthetic Resin and Its Manufacture. Edwin R. Littmann, Terre Haute, Ind., assignor to Commercial Solvents Corporation, Terre Haute, Ind.—1,618,209.

Process of Making Molded Compositions. Lawrence E. Barringer, Schenectady, and Charles F. Peterson, Scotia, N. Y., assignors to General Electric Company.—1,619,692.

Cellulose Composition and Process. William G. Lindsay, Newark, N. J., assignor to The Celluloid Company.—1,616,910.

Cellulose-Ester Composition. Joseph G. Davidson, Yonkers, N. Y., assignor to Carbide and Carbon Chemicals Corporation.—1,617,237.

Lacquer and Lacquer Enamel. Stanley D. Shipley and Guy C. Given, Stamford, Conn., assignors to Atlas Powder Company, Wilmington, Del.—1,618,481.

Cellulose Product and Method of Making Same. Horace H. Clark, Farmingdale, N. J., assignor to Clark Fibre Products Corporation.—1,618,572.

Petroleum Refining

Process of Refining Oils. Francis Javier Resines, Philadelphia, Pa., assignor to By-Products Recovery Company, Philadelphia, Pa.—1,619,486.

Method of Petroleum Distillation. William D. Mason, Richmond, Calif., assignor, by mesne assignments, to Standard Oil Company of California, San Francisco, Calif.—1,615,991.

Method and Apparatus for Distilling Liquids. William F. Downs, Chatham, N. J.; Mary Gardner Downs, administratrix of said William F. Downs, deceased.—1,616,079.

Method of Cracking Oil. Frank E. Wellman, Kansas City, Kans.—1,616,521.

Cracking Liquid Hydrocarbons. Hans O. Swoboda and Earl M. Richards, Pittsburgh, Pa., assignors to H. O. Swoboda, Inc., Pittsburgh, Pa.—1,616,515.

Apparatus for Treating Hydrocarbons. Gustav Egloff and Harry P. Benner, Chicago, Ill., assignors to Universal Oil Products Company, Chicago, Ill.—1,618,645.

Cracking Apparatus. Emanuel W. Hartman, Los Angeles, Calif., assignor to Hartman Interests, Inc., Los Angeles, Calif.—1,618,427.

Pressure Still. Alfred J. Sloan, Kansas City, Kans., assignor to Sinclair Refining Company, Chicago, Ill.—1,619,440.

Manufacture of Refined Oils. Ernest B. Cobb, Jersey City, N. J., assignor to Standard Development Company.—1,616,352.

Method of Refining Hydrocarbons. Owen David Lucas and Ernest Lawson Lomax, Westminster, England, assignors to V. L. Oil Processes Limited, Westminster, England.—1,615,286.

Apparatus and Process for Fractional Distillation and Condensation. John E. Bell, Brooklyn, N. Y., assignor to Sinclair Refining Company, Chicago, Ill.—1,619,396.

Method of and Means for Treating Oils. Edwin C. Weisgerber, Long Beach, Calif., assignor to Petroleum Appliance Syndicate, Los Angeles, Calif.—1,616,209.

Manufacture of Refined Oils. Ernest B. Cobb, Jersey City, N. J., assignor to Standard Development Company.—1,616,353.

Process and Apparatus for Removing Wax from Oil. Selden H. Hall, Poughkeepsie, N. Y., assignor to The De Laval Separator Company, New York, N. Y.—1,616,041.

Process for Conditioning Crude Oil Emulsions. Charles C. Averill, Houston, Tex., assignor to Wm. S. Barnickel & Company, Webster Groves, Mo.—1,617,737.

Process for Recovering the Oil from Mineral Oil Emulsions. Henry N. Dons, Rochester, N. Y., assignor to Nelson A. Hallauer, trustee, Rochester, N. Y.—1,617,201.

Process of Producing Lubricating Oils. Gustav A. Kramer, Concord, Calif., assignor, by mesne assignments, to Simplex Refining Company, San Francisco, Calif.—1,619,348.

Apparatus for Purifying Crude Oil. David P. Fleeger and Fred P. Osborn, Wichita, Kans.—1,616,119.

Process of Making Grease. James McKee, Chester, Pa., assignor to Sun Oil Company, Philadelphia, Pa.—1,619,352.

Process of Making Lubricants. Harley A. Montgomery, Highland Park, Mich.—1,617,455.

Pressure Still Heating Furnace. John E. Bell, Brooklyn, N. Y., assignor to Sinclair Refining Company, Chicago, Ill.—1,617,297.

Apparatus for the Destructive Distillation of Oil Shale. Lee R. Abernathy, Lead, S. Dak.—1,618,038.

Oil-Shale Apparatus. Howard E. Marsh, Lompoc, and Charles J. Dunten, Santa Maria, Calif., assignors of one-sixth to Verner B. Lee, Santa Barbara, Calif., and one-sixth to James H. Lee, Grand Junction, Colo.—1,619,525.

Treatment of Petroleum Residue. Jacque C. Morrell, Chicago, Ill., assignor to Universal Oil Products Company, Chicago, Ill. —1,618,669.

Decolorizing and Clarifying Agent. Harold S. Christopher, Berkeley, Calif., assignor, by mesne assignments, to Standard Oil Company of California, San Francisco, Calif.—1,617,476.

Combustion, Fuels and Furnaces

Art of Combustion. Carl Schwartz, New Rochelle, N. Y., assignor to International Combustion Engineering Corporation.—1,617,694.

Vertical-Chamber Oven. Carl Otto, Bochum, Germany.—1,619,535.

Production of Coke and Semicoke. Emile Baptiste Gustave Bascou, Paris, France, assignor to Societe Anonyme des Petroles Houilles et Derives, Paris, France.—1,618,563.

Coke Extractor for Vertical Retorts. Frederick Joseph West and Ernest West, Manchester, England, assignors to West's Gas Improvement Company Limited, Manchester, England.—1,617,732.

Carbonized Briquette and Its Manufacture. Samuel Forman Walton, Rose Valley, Pa.—1,618,248.

Distillation of Carbonaceous Material. John D. Zieley, New York, and Ferdinand A. Rudolf, Jamaica, N. Y.—1,617,697.

Distillation and Carbonization Retort and Process of Operating the Same. Francis Duplan, Arcueil, France.—1,618,865.

Process for Briquetting Coal. Srinivas Ram Wagel, New York, N. Y., assignor to The Lehigh Coal and Navigation Company. —1,618,029.

Tunnel-Kiln-Heating Means. Philip d'Huc Dressler, Cleveland, Ohio, assignor to American Dressler Tunnel Kilns, Inc., Cleveland, Ohio.—1,615,217.

Rotary Kiln for Burning Cement, Magnesite, Lime and the Like. Harry Stehmann, Berlin-Hohenschonhausen, Germany. —1,617,137.

Recuperator. William A. Morton, Pittsburgh, Pa., assignor to The Amsler-Morton Company, Pittsburgh, Pa.—1,619,747.

Unburned Refractory Brick and Method of Making It. August Marks, Carteret, N. J., assignor to United States Metals Refining Company, Middlesex County, N. J.—1,616,192.

Magnesite Refractory and Method of Making the Same. August Marks, Carteret, N. J., assignor to United States Metal Refining Company.—1,616,055.

Article of Sillimanite-Bonded Granular Material and Method of Making the Same. Macdonald C. Booze, Worcester, Mass., assignor to Norton Company, Worcester, Mass.—1,616,525.

Organic Processes

Dyestuffs and Process of Making Same. Fritz Straub, Basel, and Hermann Schneider, Riehen, near Basel, Switzerland, assignors to the Firm: Society of Chemical Industry in Basle, Basel, Switzerland.—1,617,872.

Copper Azodyestuffs. Thomas H. Leaming, deceased, late of Buffalo, N. Y., by Beryl Leaming, administrator, Buffalo, N. Y., assignor to National Aniline & Chemical Co., Inc., New York, N. Y.—1,618,762.

Diazo Dye of Diphenyl Urea and Chromotrope Acid. Robert James Fletcher, Irvington, N. J., assignor to The Amalgamated Dyestuff and Chemical Works, Inc., New York, N. Y.—1,617,244.

Production of Polyazo Coloring Matters. Lawrence Hugo Flett, Hamburg, N. Y., assignor to National Aniline & Chemical Co., Inc., New York, N. Y.—1,616,850.

Process for the Manufacture of Pyridine-3-Carboxylic Acid Amides. Max Hartmann and Max Seiberth, Basel, Switzerland, assignors to The Firm: Society of Chemical Industry in Basle, Basel, Switzerland.—1,617,332.

Manufacture of Diamino-Diarylurea. Fritz Heinze, Ludwigshafen-on-the-Rhine, Germany, assignor to I. G. Farbenindustrie Aktiengesellschaft, Frankfort-on-the-Main, Germany.—1,617,847.

Preparation of Solutions of Derivatives of Dioxydiaminoarsenobenzene. Stuart R. MacEwen, Toronto, Ontario, Canada.—1,615,989.

Pharmaceutical Product Containing Arsenic and Process of Making Same. Walter Schoeller and Max Gehrke, Berlin, Germany, assignors to the Firm: Chemische Fabrik auf Actien (vorm. E. Schering), Berlin, Germany.—1,616,144.

Process for the Preparation of Amino-Dianthrimides. Hugh Mills Bunbury, Manchester, England, assignor to British Dyestuffs Corporation Limited, Manchester, England.—1,616,109.

Complex Metallic Arsenobenzene Compounds and Process of Making Same. Karl Streitwolf, Frankfort-on-the-Main, and Julius Hallensleben, Hochst-on-the-Main, Germany, assignors to I. G. Farbenindustrie Aktiengesellschaft, Frankfort-on-the-Main, Germany.—1,616,204.

Process of Making Aryl-Peri Acids. Harry D. Gibbs, Penns Grove, N. J., and Edwin L. Frederick, Catonsville, Md., assignors to E. I. du Pont de Nemours & Company, Wilmington, Del.—1,617,313.

Process of Making Alkyl-Nitroaryl Ethers. Lyde Stuart Pratt and Earl H. Weltz, Penns Grove, N. J., and William Lester Mills, Chester, Pa., assignors to E. I. du Pont de Nemours & Company, Wilmington, Del.—1,619,368.

1-Methoxymethyl-3.7-Dimethylxanthine. Karl Schranz, Elberfeld, and Clemens

Lutter, Barmen-Langerfeld, Germany, assignors to Winthrop Chemical Company, Inc., New York, N. Y.—1,616,282.

Salt of a Quinolin Carboxylic Acid and Process of Producing the Same. Moses L. Crossley, Somerville, N. J., assignor to The Calco Chemical Company, Bound Brook, N. J.—1,618,172.

Process for the Production of Nuclear Substituted Aromatic Cyanogen Mercury Compounds. August Klages, Magdeburg-Sudost, Germany.—1,618,095.

Making Formaldehyde from Methylene Chloride. Erich Krause and Koloman Róka, Constance, Germany, assignors to the Firm of Holzverkohlungs-Industrie Aktien-Gesellschaft, Constance, Baden, Germany.—1,616,533.

Process of Producing Chlorocarbonates. John A. S. Hammond, Woodlawn, Md., assignor to U. S. Industrial Alcohol Co.—1,618,824.

Manufacture of Alkali-Nitrogen Fertilizers Having Urea as Their Base. Joseph Breslauer, Geneva, Switzerland, assignor to Compagnie de l'Azote et Des Fertilisants S. A., Geneva, Switzerland.—1,618,266.

Production of Fructose. William C. Arsem, Schenectady, N. Y., assignor to Industrial Technics Corporation, Schenectady, N. Y.—1,616,165.

Production of Levulose. William C. Arsem, Schenectady, N. Y., assignor to Industrial Technics Corporation, Schenectady, N. Y.—1,616,166.

Process and Apparatus for Making Concentrated Carbon Dioxide. Viggo Drewsen, Brooklyn, N. Y., assignor to West Virginia Pulp and Paper Company, New York, N. Y.—1,619,336.

Inorganic Processes

Manufacture of Aluminum Chloride. Frank W. Hall, Port Arthur, Tex., assignor to The Texas Company, New York, N. Y.—1,619,022.

Process of Making Aluminum Chloride. George L. Prichard and Herbert Henderson, Port Arthur, Tex., assignors to Gulf Refining Company, Pittsburgh, Pa.—1,616,549.

Art of Manufacture of Aluminum Chloride. Edson R. Wolcott, Los Angeles, Calif., assignor to The Texas Company, New York, N. Y.—1,617,696.

Process of Producing Sodium Aluminate. Jesse Bryte Barnitt, Pittsburgh, Pa., assignor to Aluminum Company of America, Pittsburgh, Pa.—1,616,674.

Process for the Extraction of Ammonium-Aluminum Sulphate from Aluminum-Sulphate Solutions Containing Ferric Compounds. Robert Ganssen, Grunewald, Germany.—1,619,666.

Ammonium-Nitrate Explosive. Walter O. Snelling, Allentown, Pa., assignor to Trojan Powder Company, New York, N. Y.—1,617,182.

Process of Producing Light-Resistant Lithopone. James Eliot Booge, Wilmington, Del., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del.—1,617,311.

Lithopone and Process of Increasing the Resistance Thereof to Sunlight. Herman G. Schanche, Philadelphia, Pa., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del.—1,619,376.

Manufacture of Lead Compounds. Reinhold Wilhelm, South Melbourne, Victoria, Australia, assignor to The Commonwealth White Lead & Paints Proprietary Limited, Melbourne, Australia.—1,617,887.

Process for the Manufacture of Fused Cement and Apparatus Therefor. Georges Dumas, Viviers, France, assignor to The Société Anonyme des Chaux et Ciments de Lafarge et du Teil, Viviers, Ardeche, France.—1,615,260.

Oxychloride Cement and Method of Making Same. Hans Martinus Olson, Burbank, Calif.—1,619,534.

Manufacture of Portland Cement. Carl Pontoppidan, Holte, Copenhagen, Denmark, assignor to F. L. Smidth & Co., New York, N. Y.—1,618,295.

Process of Making Sulphuric Acid. William F. Lamoreaux, Isabella, Tenn.—1,617,212.

Process of Manufacturing Nitric Acid and Nitric-Acid Salts. Georg Kassner, Munster, Germany.—1,616,900.

Process of Making Dicyandiamid. George Barsky, New York, N. Y., assignor to American Cyanamid Company, New York, N. Y.—1,618,504.

Process for the Preparation of Alkali Metal Cyanide Solutions. Kurt Andrich, Frankfort-on-the-Main, Germany, assignor to Roessler & Hasslacher Chemical Company, New York, N. Y.—1,615,208.

Method of Treating Calcium Cyanamid. George Barsky, New York, N. Y., assignor to American Cyanamid Company, New York, N. Y.—1,618,047.

Method of Producing Calcium Arsenate. Hugh K. Moore, Berlin, N. H., assignor to Brown Company, Berlin, N. H.—1,619,267.

Process of Making Metal Phosphates. Henry Blumenberg, Jr., Los Angeles, Calif., assignor to Stockholders Syndicate, Los Angeles, Calif.—1,617,098.

Process of Making Rouge. Philip J. Hess, Sr., Kokomo, Ind., assignor to Pittsburgh Plate Glass Company.—1,618,086.

Method of Making Silicofluorides and Products Thereof. Bernard Gehauf and Harold W. Walker, Edgewood, Md.—1,617,708.

Process for Recovery of Sodium Sesquicarbonate from Brines. Walter A. Kuhnert, Los Angeles, Calif.—1,618,834.

Process of Separating Zirconium and Hafnium. Dirk Coster, Haarlem, Netherlands, and Georg von Hevesy, Copenhagen, Denmark, assignors to Naamlooze Vennootschap Philips' Gloeilampenfabrieken, Eindhoven.—1,618,960.

Process for Dissolving a Mixture of Hafnium and Zirconium Phosphates and for Separating Hafnium and Zirconium. Anton Eduard van Arkel and Jan Hendrik de Boer, Eindhoven, Netherlands, assignors to N. V. Philips' Gloeilampenfabrieken, Eindhoven, Netherlands.—1,618,494.

Zirconium Compound and Method of Making Same. Charles J. Kinzie, Niagara Falls, N. Y., assignor to The Titanium Alloy Manufacturing Company, New York, N. Y.—1,618,286.

Process for the Recovery of Titanic Acid, Iron, and Magnesia from Titaniferous Ores. Frank E. Bachman, Port Henry, N. Y.; Bessie T. Bachman executrix of said Frank E. Bachman, deceased.—1,618,795.

Process for the Manufacture of Hydrogen. Joseph Rochet, Paris, France, assignor to Compagnie de Produits Chimiques et Electrometallurgiques-Alais Froges et Camargue, Paris, France.—1,617,965.

Catalyst for Ammonia Synthesis. Lucien H. Greathouse, Jamaica, N. Y., assignor of one-third to Charles H. Keel, New York, N. Y.—1,618,004.

Method of Manufacturing Effervescent Alkali Compounds. William F. Little, Kalamazoo, Mich., assignor to The Upjohn Company, Kalamazoo, Mich.—1,616,587.

Method of and Apparatus for Reconditioning Zeolite Water Softeners. William J. Kenney, Chicago, Ill., assignor to Zeolite Engineering Co.—1,617,288.

Recovery of Chlorine. Jesse A. Guyer, La Salle, and Maurice C. Taylor, Niagara Falls, N. Y., assignors to The Mathieson Alkali Works, Inc., New York, N. Y.—1,617,305.

Sulphur Composition of Diminished Inflammability and Process for Producing Same. Carl Marx, Wyoming, Milburn Township, Essex County, N. J., assignor to Union Sulphur Company.—1,619,357.

Glass Composition. William Chittenden Taylor, Corning, N. Y., assignor to Corning Glass Works, Corning, N. Y.—1,615,247.

Recovery of Bromine. Herbert H. Dow and Edwin O. Barstow, Midland, Mich., assignors to The Dow Chemical Company, Midland, Mich.—1,614,663.

Process of Producing Fertilizer Materials. George Barsky, New York, N. Y., and Frederick W. Freise, Palmyra, N. J., assignors to American Cyanamid Company, New York, N. Y.—1,614,943.

Method of Making Arsenic Acid. William C. Piver, Hillside, N. J., assignor of one-half to Willis H. Simpson, East Orange, N. J.—1,615,193.

Process for Making Barium Carbonate. Johann Eduard Marwedel and Joseph Looser, Honningen-on-the-Rhine, Germany, assignors to Rhenania Verein Chemischer Fabriken A.-G., Aachen, Germany. —1,615,515.

Pigment and Process of Making the Same. Charles Dickens, Oakland, Calif.—1,615,816.

Chemical Engineering Equipment and Processes

Disk Crusher. Edgar B. Symons, Hollywood, Calif., assignor to Symons Brothers Company, Milwaukee, Wis.—1,616,240.

Magnetic Separator. Georg Ullrich, Magdeburg, Germany, assignor to the Firm Fried Krupp Grusonwerk Aktiengesellschaft, Magdeburg-Buckau, Germany.—1,617,971.

Heat-Exchange Apparatus. Frank S. Bennett, Schenectady, N. Y., assignor to General Electric Company.—1,618,797.

Heat Exchanger. Joseph Price, New York, N. Y., assignor to The Griscom-Russell Company, New York, N. Y.—1,617,083.

Evaporative Condenser. John E. Bell, Brooklyn, N. Y., assignor to Sinclair Refining Company, Chicago, Ill.—1,619,284.

Evaporator. Joseph Price, New York, N. Y., assignor to The Griscom-Russell Company, New York, N. Y.—1,617,081.

Apparatus for Effecting Heat Transfer. Harry F. Smith, Dayton, Ohio, assignor to The Gas Research Company, Dayton, Ohio. —1,617,609.

Electrolytic Cell. Einar Sorensen, Rumford, Me., assignor to Oxford Paper Company.—1,613,966.

Process of Producing Corrosion-Resisting Coating on Iron and Steel and Products Thereof. Chad H. Humphries, Indianapolis, assignor to Metals Protection Corporation, Indianapolis, Ind.—1,614,303.

Lead Plating of Metals. William R. Dickens, Copperhill, Tenn.—1,614,662.

Segmental Crushing Roll. Carl W. Finger, Wilkes-Barre, Pa.—1,614,784.

Pulverizing Machine. Alexander M. Read, Columbus, Ohio.—1,614,899.

Distillation Apparatus. Earl R. Hamilton, Nitro, W. Va.—1,614,791.

Heat Exchanger. Robert L. Shipman, Bridgeport, Conn., assignor of one-half to Earl D. Sprague, Bridgeport, Conn.—1,615,658.

Process for the Distillation of Alcohol. Elwood I. Clapp, Baltimore, Md., assignor to U. S. Industrial Alcohol Co.—1,614,877.

Process and Apparatus for Briquetting. Ellsworth B. A. Zwoyer, Perth Amboy, N. J., assignor to The General Fuel Briquette Corporation, New York, N. Y.—1,614,095.

Filtration Process. Hiramo W. Blaisdell, Los Angeles, Calif., assignor to The Blaisdell Filtration Company.—1,614,947.

Apparatus for Crystallizing Liquids. George T. Walker, Milwaukee, Wis.—1,615,151.

Method and Means for the Purification of Water. Oskar Lasche, deceased, late of Westend, Germany, by Fritz Lasche, administrator, Dresden, Germany; and Otto T. Post, Charlottenburg, Germany, assignors to General Electric Company.—1,614,135.

Absorption Method and Apparatus. Edmund Altenkirch, Alt-Landsberg-Sud, Germany, assignor to Siemens-Schuckertwerke Gesellschaft mit beschränkter Haftung, Siemensstadt, near Berlin, and elsewhere, Germany.—1,615,353.

System for Rendering Liquids Non-Corrosive. Joseph F. Musselman, Bronxville, N. Y., and Perry West, Newark, N. J., assignors, by mesne assignments, to Elliott Company, Pittsburgh, Pa.—1,614,148.

Recovery of Volatile Substances. Josef Jannek, Gustav Wietzel, and Fritz Stoewener, Ludwigshafen-on-the-Rhine, Germany, assignors to I. G. Farbenindustrie Aktiengesellschaft, Frankfort-on-the-Main, Germany.—1,614,615.

Process of Conglomerating Fine Ores, Flue Dust, the Residue of Roasting Pyrites, Small Coke, and the Like. Otto Kippe, Osnabruck, Germany.—1,614,369.

Method for Low-Temperature Cooling, Liquefaction, and Separation of Gases. Arthur Seligmann, Bremen, Germany.—1,615,597.

Apparatus for Transforming Gelatinic Colloids Into Globules or Pearls. Wilhelm Wachtel, Berlin-Charlottenburg, Germany. —1,614,636.

Method of Purifying Sulphur. Henry H. Wilkinson, Brooklyn, N. Y., assignor to Union Sulphur Company.—1,613,632.

Treating Steam-Boiler Water. Ralph E. Hall, Pittsburgh, Pa., assignor to John M. Hopwood, Dormont Borough, Pa.—1,613,656.

Process of Making Bituminous Emulsions. Lester Kirschbraun, Chicago, Ill.—1,615,303.

Process of Carrying on Catalytic Reactions. Frank A. Canon and Chester E. Andrews, Pittsburgh, Pa., assignors to The Selden Company, Pittsburgh, Pa.—1,614,185.

Tubular Rotary Retort Fluid Distributor and Support. Edmund Wendel, Cleveland, Ohio, assignor to National Carbon Company, Inc.—1,614,220.

Process for Removing Coloring Matters and Other Impurities from Solutions. Marcel Levy, Geneva, Switzerland, assignor to The International Sugar and Alcohol Company, Limited, London, England.—1,615,091.

Process for Purifying, Enriching, or Refining Crude Graphite. Edmond Jean Eugêne Dumond, Paris, France.—1,614,352.

Sulphur Compound and Method of Making the Same. Frederick A. Frazier, Berkeley, Calif., assignor to F. A. Frazier Company, San Francisco, Calif.—1,614,063.

Revivifying Process for Carbons. Fred B. Arentz, Baltimore, Md., assignor to U. S. Industrial Alcohol Co.—1,616,073.

Process of Revivifying Carbon. Arthur A. Backhaus, Baltimore, Md., assignor to U. S. Industrial Alcohol Co.—1,619,327.

Process of Revivifying Carbon Used in Purifying Ethylene. Arthur A. Backhaus, Baltimore, Md., assignor to U. S. Industrial Alcohol Co.—1,619,326.

Apparatus for Treating Liquids with Decolorizing, Purifying, and Filtering Agents and for Separating Undissolved Substances from Liquids. Johan Nicolaas Adolf Sauer, Amsterdam, Netherlands.—1,619,042.

Method of Waterproofing Vulcanized Fiber. Emil E. Novotny and Charles J. Romieux, Philadelphia, Pa., assignors to John Stogdell Stokes, Huntingdon Valley Post Office, Pa.—1,616,062.

News of the Industry

Holders of Denatured Alcohol Must Make Reports

Treasury Decision 3049 has been rescinded by Treasury Decision 3987, and the Commissioner of Internal Revenue announces the following substitution:

"All persons owning, storing, or possessing completely denatured alcohol in quantities of 20 barrels, or drums, or more, denatured under formulas 2, 3, 4, 6 and 7, which formulas have now been withdrawn, shall make report of such alcohol to the Prohibition Administrator of the district in which it is located, giving the name and address of the owner, storer, or possessor, the quantity on hand, the number of packages, the serial number of each package, and the number of the formula under which the alcohol so owned, stored, or possessed was denatured.

"Administrators will, on receipt of such report, at once issue to the owner, storer, or possessor of the alcohol a special permit for the sale or other disposition thereof, and no sale or other disposition of such alcohol in quantities of one barrel, or drum, or more, may be made by the owner, storer, or possessor, except as authorized by the said special permit.

"All completely denatured alcohol denatured under the foregoing withdrawn formulas, together with the containers thereof, when owned, used, stored, possessed, sold or otherwise disposed of in any manner other than as herein provided, is liable to seizure and forfeiture under the law."

Tariff Hearing Probable for Sodium Silica Fluoride

A hearing probably will be called by the Tariff Commission in the near future to consider the duty on sodium silica fluoride. Cost data for the United States, for Denmark and for Holland have been compiled and the statement of information completed. Declining price levels, increasing importations and the closing of American plants indicate that the present duty is insufficient to maintain representative American production.

The Tariff Commission is now ready to reopen the investigation of linseed oil. It probably will be impossible to do any of the field work, however, until after the beginning of the new fiscal year. This means it will be toward the end of the year before a report is likely to be completed. When it became known that the report of the commission on linseed oil recommended a reduction, representatives of domestic flax growers began an active opposition to this course and demanded that the investigation cover a broader period of years. The present duty on flaxseed is forty cents per bushel. The duty on linseed oil is 3.3 cents per pound. A bushel makes 18⅔ pounds of oil. This gives the crusher a manifest advantage. Consumers of linseed oil contend that the duty could be lowered without injury to the flax growers of the West. Their entire production is absorbed by the trade in that part of the country. Any reduction of the duty under contemplation would not displace any American-grown flaxseed.

Muscle Shoals Bids Rejected by House Committee

The House Committee on Military Affairs, on March 3, at a final meeting for this Congress, unanimously agreed on a report rejecting proposals for disposition of the Muscle Shoals property, as embodied in the two bills pending before the committee. The report stipulated principles and limitations to be held fundamental in any proposed legislation submitted to the next Congress.

It says that unless a satisfactory bid is received by the time the next Congress convenes in December, an effort should be made to obtain an operating contract for fertilizer production at Muscle Shoals, and in default of that the House Military Affairs Committee should consider operation of Muscle Shoals by a government corporation.

The committee also agreed that the Federal Power Commission should not grant a preliminary permit at Cove Creek, or at any other point affecting the Muscle Shoals project, until after expiration of next session of Congress, and it requested the Secretary of War to allot funds for a preliminary survey of the Cove Creek dam proposal.

Forest Products Laboratory to Repeat Pulp-Making Course

The intensive ten-day course in sulphite wood pulp production given by the U. S. Forest Products Laboratory Feb. 10 to March 10 will be repeated March 21 to 31. The course, which is designed particularly for sulphite pulp superintendents and tour bosses, will give instruction by lectures and demonstrations in experimental cooks and in strength, yield, and bleach determinations based on research conducted at the laboratory. The methods demonstrated for sulphite cooking have resulted in better yields and greater uniformity of product than is usual in mill practice.

Program Arranged for New Haven Conclave of A. I. C.

A varied and interesting program has been arranged for the conclave of the American Institute of Chemists which will be held at Yale University, March 28. The Taft Hotel has been selected as hotel headquarters but the conclave headquarters and registration booth will be at room 153, Sterling Chemistry Laboratory. All members and guests are requested to register.

The conclave will be opened at 1.30 p.m. in the large lecture room of the Sterling laboratory. Prof. T. B. Johnson, president of the Institute will be in charge of the meeting. There will be a symposium on "Chemists' Contracts," with papers by L. V. Redman of the Bakelite Corporation, W. M. Grosvenor, consulting chemist, New York, and Prof. A. L. Corbin of the Yale Law School. After the delivery of these papers, the subject will be thrown open for general discussion. Several speakers of prominence have volunteered to lead the open discussion.

At 5 o'clock a short business session will be held and at 6 o'clock there will be a banquet in Memorial Hall of Yale University. Ladies will be admitted to the banquet. Dr. C. H. Herty will act as toastmaster.

Following the banquet a public meeting will be held at Woolsey Hall at which Henry S. Graves, provost of Yale University, will preside. At this meeting will be announced the name of the recipient of the American Institute of Chemists' gold medal for 1927. The Hon. W. H. Jardine, Secretary of Agriculture, will speak on "Agriculture and Modern Science."

Institute of Chemistry Formed By A. C. S.

George D. Rosengarten, president of the American Chemical Society, announces the formation of the Institute of Chemistry, a project sponsored by the society for the promotion of the science of chemistry in the United States. Beginning with this year, sessions will be held annually during the summer.

The Chemical Foundation, Inc., and the Pennsylvania State College will finance the first session, which will be held in July, 1927, at the Pennsylvania State College. Northwestern University will co-operate with the society in the 1928 session to be held in Evanston, Ill. Arrangements for subsequent sessions have not been made.

Flexible Tariff Clause Upheld By Court Decision

On February 24, the Court of Customs Appeals handed down a decision in the case brought by J. W. Hampton & Co. of New York, disputing the constitutionality of the Presidential proclamation which increased the import duty on barium dioxide from 4c. to 6c. per lb. Among other things the decision stated that the evident purpose of Congress as expressed in the Tariff act, imposing sufficient duties upon imported products to equalize the difference in cost of production in the United States and the principal competing country, is a valid exercise of the constitutional grant of power to Congress to regulate commerce. It was for Congress to select the means by which it thought the best interests of the country would be served in encouraging, fostering and protecting the commerce and industries of the country. Having done so within constitutional limits, the courts will not interefer. If it be said that legislation which thus protects one industry at the expense of others should be declared invalid therefor, then we must deny to the Congress the power to lay any duties at all. The power to lay duties implies the power to select the objects upon which such duties are laid. Necessarily, the laying of a duty upon one product and not upon another may give added advantage or disadvantage to the domestic producer of the product thus made dutiable. But what might be said of the inequality of the laying of duties may also be said of all taxes laid for public purposes. The needs occasioned by drought, famine, pestilence, and flood, the pauper, the dependent, and the criminal, are burdens unequally borne; and yet, while the means of one citizen are taken from him to minister to another, it is still deemed to be a public purpose, the benefits of which all citizens equally enjoy. The right of our National Legislature to take such steps as the people, acting through it, may think best suited to protect, foster, and encourage its commerce and industrial life cannot be denied; for to so deny it would be to deny the sovereign right which every properly constituted government has to perpetuate itself and to accomplish one of the chief purposes for which it was created.

Southern Electrochemical Co. Wins Appeal

On March 1, the United States Circuit Court of Appeals handed down a decision in favor of the Southern Electrochemical Co. in its action against E. I. du Pont de Nemours & Co. for infringement of the patent for the denitration of sulphur acid and the concentration of nitric acid. The patent, originally held by Harry Pauling, an Austrian, is now the property of the Southern Electrochemical. The latter company brought suit for infringement in the U. S. District Court of New Jersey and the decision of that court was in favor of the du Pont company. The Court of Appeals by its majority opinion reversed this decision and ordered the du Pont company to render an accounting of profits accruing from the infringement.

Caustic and Acid Labeling Bill Passed By Congress

The bill known as the Federal Caustic Poison act was passed without opposition shortly before adjournment of the recent Congress. The bill which had passed the senate last spring was reported favorably by the House Committee and after being ratified by both branches was signed by the President on March 4.

The bill was favored by the American Medical Association and was designed chiefly to require the use of poison labels on lye sold for household use. The American Drug Manufacturers' Association in protesting against the bill offered no objection to a requirement for a poison label on lye, but opposed latitude of the bill, which applies to a long list of caustic or corrosive acids and alkalis.

It prohibits the shipment or delivery for shipment in interstate or foreign commerce of any dangerous caustic or corrosive substances in a misbranded parcel, package, or container suitable for household use. The term "misbranded" is defined as meaning poisons of a conspicuous label bearing the word "poison" in legible type.

Dye Division of A.C.S. Will Hold Meeting at Richmond

The regular meeting of the Dye Division will be held in connection with the Spring Meeting of the American Chemical Society in Richmond, Va., from April 11 to 15, inclusive. As Richmond is so near the southern textile centers, an especial attempt has been made to place papers on the program of the Dye Division which will be of interest to users of dyes as well as manufacturers. Prof. W. D. Bancroft, of Cornell University, will speak on the "Theory of Dyeing," and there will be other papers covering the application of dyes to textile fibres from a theoretical and practical standpoint. An interesting feature of the meeting will be a discussion of the present handling of organic chemical patents, with special reference to dyes. Arrangements have been made for a thorough discussion of this subject, as the question is one of great importance, especially to manufacturers of dyes. Other papers from leading manufacturing and university laboratories will deal with subjects of theoretical and practical interest.

Industrial Exhibition Will Be Held at Cleveland

The Committee on Industrial Development of the Cleveland Chamber of Commerce announces the Cleveland Industrial Exposition, to be held in the Cleveland Auditorium, August 6 to 28. The project is indorsed by the Ohio Chamber of Commerce, and the committee in charge is under the presidency of Joseph H. Alexander, president of the Cleveland Railway Co. The Exposition Committee is composed of men prominent in the financial and industrial activities of Cleveland.

Technical Papers Featured Annual Meeting of T.A.P.P.I.

A new fiber-making process, in which waste wood chips are exploded by high-pressure steam was the outstanding paper presented at the Twelfth Annual Meeting of the Technical Association of the Pulp and Paper Industry held at the Waldorf-Astoria Hotel, New York, Feb. 21 to 24. The process was developed by W. H. Mason, vice-president, Mason Fibre Co., Laurel, Miss., and was describd briefly on p. 732 of the December, 1926, issue of *Chem. & Met.* Insulating board and hard-finish board are the chief products thus far developed. Other contributions of interest were: "Power Requirements," by S. A. Staege; "Paper Drying," by S. W. Fletcher; "High Pressure Steam," by Hosea Webster; "Drum Filters," by H. A. Morrison; "Process Control," by R. H. Stevens; "Application of X-Rays," by G. L. Clark; "The Technical Man's Field," by A. B. Green; "Strength Testing," by G. P. Genberg; "Mineral Coated Paper," by G. K. Hamill; "Groundwood Control," by R. L. Schadt; "Groundwood Screenings," by C. K. Andrews; "Grinder Comparisons," by A. F. Meyer; "Freeness Testers," by Allen Abrams; "Soda Investigation," by D. E. Cable, R. H. McKee and R. H. Simmons; and "Soda Estimation," by C. K. Textor and W. F. Hoffman.

Lively discussion was caused by Mr. Green's paper, which set forth a proposal for centralized research to be financed by a group of co-operating paper mills. Discussion disclosed that the U. S. Forest Products Laboratory was in need of funds in order to complete fundamental investigations now underway and that the most logical move at the present time would be a fuller utilization of present research organizations, rather than the promotion of another and distinctly separate venture.

Swedish Interests Will Exploit Esthonian Oil Shale

A concession has been granted by the Esthonian government to Swedish interests for the breaking of a billion tons of oil shale, according to advices from Assistant Trade Commissioner Emil Kekich, Stockholm.

A trial plant is already being built where distillation of shale on a manufacturing basis will be undertaken, and the intention is to build several new factories if the trial manufacture during the first year proves to be as favorable as previous experiments. To begin with, 50,000 tons of shale will be treated annually.

President Signs Helium Bill

President Coolidge on March 4 signed the bill authorizing the conservation, production, and exploitation of helium gas. The measure is primarily to protect the supply of helium for the Army and Navy. It authorizes the Secretary of Commerce to acquire lands or interest in lands for the purpose.

News from Washington

By Paul Wooton

WASHINGTON CORRESPONDENT OF *Chem. & Met.*

THE German chemical industry, once so aloof and so self-sufficient, controlling 75 per cent of the world's dyes and most of its pharmaceuticals now is more than willing to make agreements and enter into combines with foreign producers in the hope of holding a portion of world trade which it once all but monopolized. Concessions to foreign interests arc not confined to trade abroad as they have been taken into partnership in various German chemical enterprises. Just at this time Germany and Japan have their heads close together and a series of agreements may be a development of the near future.

This new chemical policy of the Germans has been pushed further in Great Britain than in any other country. The Nobel Industries, Ltd., and the Interessen Gemeinschaft are in joint production of both viscose and acetate artificial silk. The Nobel company also is in the German explosives combine and the I. G. Deutsche Gasolin. The formation in Great Britain of the I. G. Dyestuffs, Ltd., was the sensation of last Summer. Now Brunner Mond & Co., Vickers and United Steel are reported to be co-operating with the German dye trust in the exploitation of the Bergius process of coal hydrogenation.

The Anglo-Persian Oil Co. and the dye trust are believed to be co-operating closely along certain lines. The H. J. Schroeder banking concern, which led the recent $75,000,000 potash loan, is participating further in German financing, while another British financial group has loaned £400,000 to the Oberschlesische Kokswerke and Chemische Fabriken A. G.

Germany and England also have production and price agreements covering borax, creosote oil, benzol, glue, saccharine and superphosphate.

While the Germans have not made the same progress in this country with co-operative plans as they have in the United Kingdom, some very definite developments along that line have taken place. The Dupont company is an associate in the German explosives combine. The Standard Oil Co. owns 25 per cent of the stock in the Deutsche Gasolin. The Bayer Co. has had an agreement with the Grasselli Co. since 1924. The I. G. has consolidated its American sales forces in the General Dyestuffs Corporation, formerly H. A. Metz & Co. The Von Heyden and Bemberg companies have opened plants in the United States. In this connection there also should be mentioned the historical loan by Dillon, Read and Co. and Kuhn, Loeb & Co. to the Badische, Bayer and the Agfa.

Tariff Developments

The Tariff Commission hearing on edible gelatine disclosed that there is only a slight difference between the cost of production of that product in the United States and in Holland. Under such conditions the Tariff Commission usually makes no recommendations and it is assumed that the report in this case went to the President without suggestion as to whether or not the duty should be raised or lowered.

Casale Process Operations

Plants operating under Casale licenses on Jan. 1, had a capacity of 318.5 metric tons of anhydrous ammonia per twenty-four hours. Plants under construction when completed will have a capacity of 439 tons per twenty-four hours. A table listing the individual plants follows:

Plants Operating Under Casale Licenses

Country	Company	Plant	Capacity (Anhydrous Ammonia in 24 hours) Operating, Tons	Building, Tons
Belgium	S. A. des Fours à Coke Solvay & Piette	Ostende	24	...
	Etablissements Kuhlmann	Selzaete	....	24
England	The United Alkali Company, Ltd	Widnes	....	10
France	Cie d'Alais Froges & Camargue	St. Auban	2	10
	Sté des Mines de Dourges	Henin Lietard	15	...
	Sté des Mines de Lens	Pont a Vendin	22.5	...
	Sté des Mines de Vicoigne Noeux & Brocourt	Henin Lietard	15	...
	Cie Prod. Chimiques Anzin Kuhlmann	Anzin	22.5	...
	Sté Houillère de Sarre & Moselle	Carling	....	15
	Sté des Engrais Azotés & Composés	Soulom	....	48
	French Gouvernment	Toulouse	....	180
	Sté des Mines de Marles	Marles	....	24
	Cie Prod. Chimiques Roche la Molière	Firminy	15	...
Italy	Società Italiana Ricerche Industriali (SIRI)	Terni	5	...
	Terni, Soc. per l'Industria e l'Elettricità	Nera Montoro	31	...
Japan	Nippon Chisso Hiryo Kabushiki Kaisha	Nobeoka	62	...
	Nippon Cnisso Hiryo Kabushiki Kaisha	Minamata	60	40
Yugoslavia	Soc. Ital. Forza Idrauliche della Dalmazia	Dugirat	....	48
Russia	Severny Chimichesky Trust	Minjinovgorod	....	24
Spain	Energia & Industrias Aragonesas	Sabinanigo	15	...
Switzerland	Usines Electriques de la Lonza S. A.	Viège	7	16
United States	Niagara Ammonia Corp	Niagara Falls	22.5	...
			318.5	439

N.B. Tonnage indicated refers to metric tons of anhydrous ammonia in 24 hours.

The plants of the Societe des Mines de Lens and the Societe Houillere de Sarre et Moselle have been assembled, according to information reaching Washington, but they have been unable to operate as their hydrogen plants have not been completed. The French government plant at Toulouse, consisting of nine units of twenty tons each, was scheduled to begin operation March 1. This plant will use hydrogen extracted from water gas. The Pyrenees plant of the Societe des Engrais Azotes et Composes will begin production with its first unit this spring.

The new plants at Henin Lietard, Anzin and Firminy are operating with hydrogen derived from coke oven gas. The Rombacher-Linde and the Alais Froges and Camargue processes are used for hydrogen extraction. The Semet Solvay and Piette plant derives its hydrogen from illuminating gas by the Rombacher-Linde process. The Minamata plant in Japan is the first to operate twenty ton units. Smaller units have been given an output of from ten to fifteen per cent higher than their nominal capacity. It was found that the same was true with the larger units.

Watson Heads Chemical Division

W. N. Watson is in charge of the Chemical Division of the Tariff Commission, succeeding C. R. DeLong. Mr. Watson was educated at Bates College, Massachusetts Institute of Technology and Harvard University. His commercial experience was confined largely to the chemical staff at textile mills. He served two years with the Chemical Warfare Service during the war and has been with the Tariff Commission for the past seven years.

Two chemists will be added to the staff of the chemical division after July 1. Appropriations then will be available which will allow this strengthening of the chemical division which has been short-handed for the past several months.

In the collection of the dye census now being taken, the industry has responded more promptly than ever before. There are now only a few returns outstanding. This will make it possible for the Tariff Commission to issue its preliminary statement on dyes and other organic chemicals not later than April 1. The statement will contain both sales and production figures on the principal dyes, intermediates and other finished coal tar products, along with certain non-coal tar synthetic organic chemicals.

The data covering the foreign costs of producing tartaric acid have been gathered and the work on the statement of information is progressing rapidly. It is probable that a public hearing in connection with this case will be held in May.

The Commission also has received the foreign cost data on glue. The information is being embodied in the statement of facts and a hearing will be held some time during the Spring.

Institute of Chemical Engineers Holds Annual Meeting in London

Sir Alexander Gibb Elected President for Ensuing Year—Interesting Exhibits on View at British Industries Fair

From our London Correspondent

THE annual meeting of the Institute of Chemical Engineers was held in London from March 9 to 11, and the new president is Sir Alexander Gibb, G.B.E., C.B. Among the papers presented at the conference was one by Dr. Bush and Mr. Grounds upon the efficiency of the Schmiedel box in sulphuric acid manufacture. It will be remembered that during the last few years several plants have tried this roller spray device and it was at first thought that it could be used as a substitute for the lead chamber. It now appears that its function is preferably that of an auxiliary device for increasing the output in a manner similar to that of the intermediate tower. This is the fifth annual meeting of the institute, which has now found a recognized place in the general scheme of chemical engineering endeavor and is likely to attain to the prestige and power of its American progenitor. Sir Alexander Gibb, the new president, is a civil engineer with an enviable record of achievement and it is to be hoped that he will be able to visit the United States on the occasion of the joint meeting with the American institute. The new vice-presidents are W. A. S. Calder, general manager of Messrs Chance & Hunt, Ltd., of Oldbury, which is one of the subsidiary companies of Brunner Mond & Co., and J. A. Reavell, of the Kestner Evaporator Co. C. S. Garland, who was one of the delegates to America in 1921, continues in his office as registrar of the institute.

The technical and commercial world showed considerable interest in the British Industries Fair held last month in London and Birmingham. There can be no doubt that the value of this fair is increasingly appreciated, not only by buyers that come from all parts of the world, but also by the exhibitors, many applicants for space having been disappointed this year. Most of the space in the Chemical Hall, London, was given to the exhibits of Imperial Chemical Industries, Ltd., and the result was most impressive and worthy of the four companies constituting this great undertaking. The Chemical Hall is on lines similar to those of previous years and does not show the same advance in organization and arrangement that characterizes the remainder. It was also noticeable that the staff in attendance were frequently insufficiently informed about the products of the firms they represented, and there was a tendency to let the exhibits speak for themselves. One of the most interesting exhibits was that of the Gas Light and Coke Co. whose stand was completely lighted by a new type of incandescent gas mantle which gives substantially true daylight and in a very effective manner. The modern incandescent gas light can be turned on and off with a switch, just like an electric light, and in this country, until the new electricity bill brings power and light to remote country districts, there will still be room for the use of gas for lighting in addition to domestic and industrial heating.

Chemical markets are improving, especially heavy chemicals, and the general impression is that prices will be well maintained and that export inquiry will also be stimulated and at more remunerative figures.

The details of the international arrangement between Courtaulds and the corresponding German and Italian artificial silk manufacturers has already been given full publicity, but the far reaching effects of this arrangement upon the heavy chemical industry are not yet fully realized. The negotiations were in progress for a long time and it is believed that their successful outcome is to a large extent due to Ernest Lunge, the son of Prof. George Lunge, of Zurich. Mr. Lunge is with Messrs. Courtaulds Ltd., and it is rumored that he will be given a seat on the board of directors of one of the other companies.

Considerable technical progress is reported by the Beetle Products Co., Ltd., which is a subsidiary of the British Cyanides Co., Ltd., which latter has been so hard hit recently by the cyanide market and especially by the import duty on these products into the United States. Arrangements have been made for the marketing of synthetic resins and moulding powders based upon thiourea condensation products, the particular advantage of which is that they are nearly colorless and therefore white and brightly colored articles can readily be produced. The chief London stores have already exhibited these products and at the British Industries Fair there was a most impressive exhibit of domestic and ornamental tableware under the trade name of "Bandalasta," the makers being Messrs. Brookes & Adams, Ltd., of Birmingham. The articles so made are translucent, and marble and alabaster effects can therefore be successfully obtained. The material is, of course, non-fragile, odorless and tasteless, very light and when used for cups, does not burn the fingers when used for hot liquids. As in the case of aluminum articles, washing soda or soap powders must not be used and at the prices quoted, there should be a considerable market for all kinds of novelties and as a substitute in many cases for china and pottery.

Holden & Brooke, Ltd., of Manchester, have recently placed on the market the "Vulcaloid" acid pump, which presents many interesting features and sells at a low price. The pump body is in cast iron, lined with hard rubber, which is made to cohere very tenaciously by means of a special vulcanizing process. To illustrate the perfection of the product obtained, the standard practice is to subject all vulcanized parts to a test pressure of 2,000 volts alternating current and it is considered that the resulting pump is more satisfactory in use than the adoption of a solid vulcanite impeller and casing.

Last year, occasional reference was made to the new combustion steam generator, which was installed near Manchester under the auspices of International Combustion, Ltd. The early trials of this full sized unit were very encouraging, but progress was held up by the coal strike. Recently, the combustion steam generator has been started up under commercial operating conditions and is stated to be operating satisfactorily. The behavior of this new type of boiler, in which the combustion chamber is inside the water tubes of the boiler itself and by which refractory brickwork is almost eliminated, will be awaited with interest, particularly in the United States, where it is understood that many orders have been placed or are pending.

An excellent illustrated article has just appeared in the "Industrial Chemist" describing the application of the stream-line filter to the reclamation of dry-cleaning spirit. Used dry-cleaning spirit contains in addition to the dirt and the added soap, the natural oil from materials such as woollens. Of these, only the dirt need be removed, as the valuable soap can be retained as a detergent and there is also an advantage in retaining the natural oil. The filtration of this spirit presents many unusual and difficult problems, both as regards variation in the rate of filtration and in regard to the temperature and physical conditions under which it is carried out. The stream-line filter appears to have solved this problem completely and satisfactorily and is likely to surplant the alternative method of distillation, from which the residue is difficult of disposal.

Rice Hulls Used as Material For Cellulose Production

The Massasoit Mfg. Co., Fall River, Mass., manufacturer of textile fabrics, has begun operations at its new mill at Lake Charles, La., designed to produce cellulose from rice hulls and rice straw. The plant is said to be the only one of its kind in existence, and represents an investment of about $200,000. The company, a pioneer in the utilization of waste products, made initial experiments with rice hulls for cellulose production at its Oakdale mill, about two years ago, and the success attending this work led to the establishment of the Lake Charles mill, made possible through the co-operation of the Lake Charles Rice Milling Co., occupying an adjoining site. The plant is located on a tract of about 5 acres of land, and consists of six units, with estimated capacity for utilizing 16,000 tons of rice hulls per annum. A storage warehouse has been built for ground hull service, with facilities for handling 6,000 tons at one time, a supply sufficient to keep the mill active for about 5 months after the rice mill season has closed. Rice hulls, heretofore, have been considered as waste material, usually destroyed in furnaces.

Recovery in French Exchange Leads to Business Depression

Decline in Export Trade Pronounced in Many Lines—Franco-German Commercial Agreement Renewed for Three Months

From our Paris Correspondent

RECOVERY of the French currency has had an unfavorable effect on general business, in fact it has been credited with creating a depression in many lines. The first effect of the change in the monetary situation was found in a marked falling off in export trade. This condition failed to improve even after the tax on exports had been made ineffective. The automobile trade has suffered to the greatest extent. The textile trade, likewise, has found a curtailment of its markets and naturally this has had a tendency to cut down home consumption of chemicals and dyes. The rayon industry not only has suffered through loss in export trade but has met with keen competition in French markets. The low position of Belgian exchange places that country in a favorable situation to capture a large part of the rayon business of France. As a result of lessened industrial activities about 100,000 workers are now idle and the plants which are operating are on part-time schedules. The government is trying to improve matters by influencing a lower level of prices in general. For instance it has forced a reduction in prices for coal.

Franco-German Agreement

The Franco-German commercial agreement which came to an end on Feb. 20 was renewed for a three-month period. The renewal, however, carries the provision that if by March 31, the German government has not reached a definite decision regarding importations of French wines into Germany, the entire agreement will be abrogated. That complications may arise is seen from the fact that 2,500 German products are accorded preferential rates on entry in France, while more than 4,000 French products are granted favored rates when imported into Germany. Furthermore the working out of these preferential rates does not meet with universal approval in France. This may be exemplified in the case of sodium hydrosulphite. There are three manufacturers of this chemical in France, the Kuhlmann Establishments, the Societe Industrielle des Derives du Soufre at Lomme-lez-Lille, and the Mazure Establishments at Rouen. These producers complain that present import duties are not sufficiently high to give protection to the French product.

Raymond Berr, chief director of the Kuhlmann Establishments, recently read a paper in which he stressed the importance of highly concentrated fertilizers. He called attention to the plans of the I. G. in Germany which call for the marketing of such products. While his paper was largely technical it was construed as a movement to direct attention of French chemical manufacturers to the danger which threatens from mergers of large chemical interests in other countries and thus to invite mergers among French producers. As these highly concentrated fertilizers are made by the distillation of superphosphate with silica and coal in the electrical furnace. The phosphorous thus obtained is oxidized into phosphoric acid which is neutralized by ammonia or potash. It is evident then that extensive use of such fertilizers would have a direct bearing on production of sulphuric acid which now finds its widest outlet in the fertilizer trade. Mr. Berr pointed out that a decline in sulphuric acid production could be made up by a larger use of catalysis. He stated that formerly the Kuhlmann concern prepared phthalic anhydride by the action of oleum on naphthalene. This has been replaced by a method which consists of catalytic oxidizing of naphthalene vapors. The low priced phthalic anhydride thus produced has encouraged production of synthetic anthraquinone, starting from phthalic anhydride and from benzine. He also referred to phenol consumption which has outstripped the productive capacities of gas plant and coke-oven works and stated that the way was open to produce this chemical by the catalytic oxidizing of benzine.

Taxes on French patents and trade marks have been modified. Taxes on patents are 300 francs per year for the first five years, 400 francs per year for the second five years, and 500 francs for each succeeding year up to the fifteenth year. The taking out of a patent costs 300 francs, one-half of which is returned if the patent is not granted. Trade marks are taxed at the rate of 20 francs each.

Synthetic Camphor Manufacture

The manufacture of synthetic camphor in France appears to have met with little success. The Societe Alsacienne de Produits Chimiques is reported to be having difficulties. The company has given up its Mulhouse works to a group composed of Kuhlmann, Saint-Dennis, and the Usines Chimiques du Rhone. Another company, the Industrial Society of Synthetic Camphor with a capital of 500,000 francs, is winding up its affairs.

It is reported that the Kuhlmann Establishments is about to erect a plant for the manufacture of methanol with the co-operation of Mr. Patart, which plant is to turn out several tons per day while the mines of Béthune, the chief director of which Mr. Mercier died recently, are setting up the Audibert process. The Patart, as well as the Audibert process are both based on the fixation of carbon monoxide on hydrogen in presence of an appropriate catalyser by a given temperature and pression. The Audibert process has just been published French patent 613,896, July 31, 1925; delivered Dec. 1, 1926.

The Patart process holds priority over the patents held by the Badische Anilin and Soda-Fabrik but production of synthetic methanol in Germany antedates that in France.

Net Weight Terms Proposed for Sale of Rosin

On February 21 to 23, at Jacksonville, Florida, about 300 producers, dealers, and users of naval stores participated in the fourth annual "Get-together Conference" of the naval stores industry. The plans and program for this meeting were arranged under the general chairmanship of Carl F. Speh, secretary-manager of the Turpentine and Rosin Producers Association of New Orleans, with active local direction of Thomas J. Aycock, of Jacksonville. The success of the conference is attested by the very general desire for a fifth conference to be held next year, at a time and place to be fixed later. Mr. Aycock is to serve as general chairman for the conference.

The basis for sales of rosin was considered at length by the conference as a result of an appeal by representatives of the varnish industry, which constitutes one of the largest user groups. It was decided to have a committee appointed which should take up with all consuming industries as well as with producers and dealers a plan of selling rosin on net weight. The present basis of sale is gross weight, including weight of the wooden barrel, on a nominal unit of a 280 pound barrel. The actual package is, however, about 500 pounds weight, including the barrel. The nominal 280-pound barrel, one-eighth of a gross ton, is the traditional unit of sale, dating back to the old exportation of naval stores through Southern ports to England in colonial days.

A desire was evident for more prompt and complete statistical service for the industry. It was, therefore, formally voted by resolution to request government agencies to take steps to get out more promptly after the end of the season, complete statistics regarding production, stocks, export, and domestic consumption. At the present time the Bureau of Chemistry does this work on stocks and consumption, but the production figures have been variously gathered partly by the Bureau of Chemistry, partly by the Bureau of the Census and recently in part by the industry itself.

Shale Oil Now Available for Experimental Work

Shale oil obtained in the operation of the government's experimental plant near Rulison, Colo., is now available for distribution to laboratories that might be interested in conducting tests with such oils, the Bureau of Mines has announced. A Scottish-type retort and an American type of retort, known as the N-T-U, are now being operated at the experimental plant, and oils from both types of retort are available for investigative work. The bureau is anxious to distribute this shale oil as widely as possible in order that studies may be conducted by universities, commercial laboratories, and laboratories of oil companies.

News in Brief

New Caustic Soda Plant in Italy—A report from E. Humes, commercial attaché at Rome, says the Societa Italiana di Elettrochimica soon will be producing 200 to 250 metric tons monthly of 95 per cent caustic soda, by the electrolytic process employing the mercury cathode. The plant was erected under the terms of an agreement with the Societa Generale Italiana della Viscosa, whose subsidiary, La Supertessile, has a rayon plant at Rieti not far from Bussi, where the electrolytic soda is used in the production of rayon by the Viscose process.

Cornell to Give Summer Courses in Microscopy—Instruction in the technique of microscopy, crystal studies, microscopic qualitative analysis and the examination of textile and paper fibers will be offered by Cornell University during the summer term beginning July 5. Inquiries should be addressed to Dr. C. W. Mason, Department of Chemistry, Cornell University, Ithaca, N. Y.

Akron Made Port of Customs Entry—The Treasury on March 7 advised all customs officials of the creation of Akron, Ohio, as a customs port of entry. Announcement of the new port was made following promulgation by the President of an executive order establishing a port at Akron in Customs District No. 41, with headquarters at Cleveland.

Cleveland a Large Paint-Making Center—Through a recent survey of the production of paint at Cleveland, O., it was found that the annual production is now averaging 825,000,000 lb. per year. The plants in that district have annual sales of $115,000,000, and a gross capitalization of $75,000,000. The yearly payrolls for workers in the paint industry at Cleveland total in excess of $16,500,000.

Michigan Alkali Company Expands—The Michigan Alkali Co., Wyandotte, Mich., has contracted for a new byproduct coke and gas plant for its local works. The new expansion will consist of a battery of 39 Koppers-Becker type combination coke and gas ovens, with complete equipment for the recovery of benzol and other byproducts, as well as for the handling of coal and coke. The unit will have an annual carbonizing capacity of 350,000 tons of coal. It is expected to be ready for service during the summer.

Pulp and Paper Research Laboratory for Montreal—Plans are being arranged by the Research Section of the Canadian Pulp and Paper Association for the establishment of a laboratory at Montreal. The committee in charge has reported favorably for the proposed research station, and a fund of $350,000, will be secured to carry out the project. The plan provides for the issuance of 20-year, 6 per cent bonds, with members of the association to subscribe for a pro-rated allotment of the issue. The laboratory is to be operated jointly by the pulp and paper division of the Forest Products Laboratories, and the Department of Industrial and Cellulose Chemistry of McGill University.

State Cement Plant a Failure—According to reports submitted on the physical and financial conditions of the state-owned cement mill at Chelsea, Mich., by committees appointed by Gov. F. W. Green, the plant as a going proposition under state direction is a failure. The investigation of the physical condition covered plant, equipment and stock, and sets forth that the committee is heavily critical of the enterprise as a state venture. The governor purposes to submit recommendations to the State legislature for the disposition of the plant.

Aluminum Bronze Manufacturers Organize—Aluminum Bronze Manufacturers' Institute is the name of a research organization formed recently by the following constituent companies: American Metals Products Co., Milwaukee, Wis.; Buffalo Bronze Die Cast Corporation, Buffalo, N. Y.; Duriron Company, Dayton, Ohio; Hills-McCanna Company, Chicago, Ill., and The Michigan Smelting and Refining Company, Detroit, Mich. Through co-operative advertising, research and development, the Institute plans to establish the reputation and increase the use of aluminum bronze as an engineering material. W. M. Corse, metallurgical engineer, has been appointed director of the Institute with central offices at 810 Eighteenth St., Washington, D. C.

Prizes Offered for Papers on Arc Welding

The American Society of Mechanical Engineers has accepted the custody of $17,500 offered by the Lincoln Electric Co., Cleveland, Ohio, to be awarded by the society for the three best papers disclosing advancement in the art of arc welding, presented under the rules governing the competition. Three prizes will be awarded, $10,000, $5,000 and $2,500, provided the papers are of sufficient importance and value to justify, in the opinion of judges appointed by the society, the awarding of such prizes. The society has issued a bulletin containing the rules of the competition and many suggestions to those who propose to compete. Copies of this bulletin may be procured from the society at 29 West 39th St., New York, N. Y.

Engineering Fellowships At University of Michigan

Six fellowships in graduate chemical and metallurgical engineering studies will be available for the school year 1927-28, announces the University of Michigan. During the current year, 28 graduate students have been in residence in the Department of Chemical Engineering, and of these 16 are candidates for the Ph.D degree. The University offers summer courses of eight weeks duration, beginning June 27. Both graduate and undergraduate courses are included in the summer courses.

Barrett Co. to Recover Cost of War-Time Xylol Plant

The Barrett Co. is entitled to recover from the United States the cost of constructing and equipping a plant at Frankford, Pa., for the distillation of xylol during the war, the United States Supreme Court held February 21 in a decision by Chief Justice Taft which reversed a decision by the Court of Claims. The company erected the plant under contract that the government was to furnish the funds, all of the product being for the use of the navy and the xylol to be distilled and refined from special solvent naphtha furnished by the government. The estimate of cost was $253,321 and this amount was paid by the government. The total expense at the time of the armistice however had reached $337,780, due to increasing labor costs and changes in design made with the knowledge of the government even if not with its specific consent. The plant was not completed when the armistice was signed and the contract was concelled. Subsequently, the company purchased the plant from the government for $110,000. The company sued for $84,459, the difference between the estimated cost of the plant and the actual cost. The Court of Claims held that it was not entitled to this sum. The Supreme Court reversed this decision.

Decline in Sicilian Sulphur Production Last Year

In a report from Palermo, forwarded by Consul E. L. Nathan, it is stated that the Sicilian sulphur industry in 1926 showed less favorable conditions than in 1925. Production for the fiscal year of the Sulphur Consortium which ended July 31, 1926, amounted to only 202,856 tons as compared with 223,604 tons in the previous fiscal year. Shipments of sulphur aggregated 221,386 tons in the fiscal year 1925-26, while in the previous fiscal year they amounted to 292,222 tons. The general depression in this industry continues and indeed conditions would be worse if it were not for the agreement fixing the minimum selling price. Nevertheless there were no labor troubles as in 1925 since the miners are hoping for an early amelioration promised by the government.

Oil Storage Plant Protected From Lightning

The Pan-American Petroleum Co., Los Angeles, Cal., has just completed the installation of a new system of lightning protection for its local storage plant, said to be the largest oil reservoir in the world. The system was invented by John Milton Cage, Los Angeles. The apparatus consists of a series of points or barbs on wire, installed on poles in circular formation around the reservoir, or area to be protected. The poles average from 80 to 100 ft. in height; there are three strands of wire and these are connected to ground water. The installation provides an electrical path for the return of the current to the storm in the same degree as it comes to earth in a rainfall.

Men You Should Know About

W. H. PFEIFFER, formerly with the Department of Ceramic Engineering, University of Illinois, has become a member of the research staff of the Carborundum Co., Niagara Falls, N. Y.

C. R. JOHNSON has been appointed technical director of Godfrey L. Cabot, Inc., Boston, Mass., and will give particular attention to carbon black research.

Dr. WILLIAM M. BURTON, president of the Standard Oil Co. of Indiana, Chicago, has resigned, but will continue as a director of the company. Edward G. Seubert succeeds him as president.

MERLE P. CHAPLIN, for many years with the technical department of the Keyes Fibre Co., Waterville, Me., has become chief engineer for the Rexpulp Co., Inc., Chicago, recently organized.

J. F. BURNESS is now with the Cary Paint Mfg. Co., Rogers, Ark., recently organized, and will be in charge of chemical and research operations.

AUSTIN J. PAUL, heretofore with the Department of Ceramics, University of Illinois, has become a member of the research laboratory staff of the Ceramic Engineering Department, School of Mines and Metallurgy, Rolla, Mo.

ALEXANDER B. CUTLER, lately instructor in paper and pulp chemistry at the University of Maine, Orono, is with the technical staff of the pulp and paper division of the United States Testing Co., New York.

J. H. WAGGONER has been awarded a fellowship at the Mellon Institute of Industrial Research, and will conduct an investigation of high-tension glass insulators.

A. S. HUNDER, formerly a fellow at Mellon Institute, has become a member of the research staff of the duPont Rayon Co., Buffalo, N. Y.

M. G. BABCOCK has been appointed manager of the refractories department of the Pittsburgh Glass Co., Pittsburgh, Pa., succeeding A. Hart Chandler, deceased.

WALTER M. SCOTT has recently resigned as chief chemist for Cheney Brothers, Inc., South Manchester, Conn., to go with the National Aniline & Chemical Co., New York.

CHARLES D. WATERS has resigned as head chemist for the Peshtigo Paper Co., Peshtigo, Wis. He will be located at Newton Falls, N. Y., in the future, acting as chief chemist for paper interests in that section.

O. H. CALDWELL, editor of *Radio Retailing*, a McGraw-Hill publication, has been appointed by the President as a member of the Federal Board of Radio Control.

LEWIS BUCKLEY STILLWELL was reelected chairman of the Engineering Foundation for the third time at its annual meeting held on Feb. 17.

ARTHUR D. LITTLE, founder and president of Arthur D. Little, Inc., has been elected a vice-president of Engineering Foundation.

H. P. MACGREGOR has severed his connection with the Merco Nordstrom Valve Co., New York City, and will establish himself as a consultant in St. Louis, Mo. He can be reached at 310 Title Guarantee Bldg., St. Louis, Mo.

Dr. ALFRED EISENSTEIN of Vienna, Austria, and H. B. JESPERSEN of Copenhagen, Denmark, are spending a few weeks with Arthur D. Little, Inc., Cambridge, Mass., with whom they are associated as European correspondents and consultants.

Dr. ROGER ADAMS, professor of organic chemistry and head of the Department of Chemistry at the University of Illinois, received the William H. Nichols medal for 1927 as a recognition of his work on the acids of chaulmoogra oil. Presentation was made at the meeting of the New York section of the American Chemical Society, held in Rumford Hall, March 11. Dr. Adams has been successful in synthesizing two series of acids and several other compounds of a cyclic structure that have proved more effective bactericidally toward *B. Leprae* than the natural acids from chaulmoogra oil. Clinical experiments to determine the effectiveness of these compounds against leprosy in humans are now being carried on in the Philippines.

Roger Adams

Dr. M. SEM, the American representative of the Soderberg Electrode System and the Norwegian company, Det Norske A/S for Elektrokemisk Industri, Oslo, Norway, has arrived in the United States and can be addressed at the Hotel Commodore, New York.

DUFF A. ABRAMS, for many years director of the research laboratory of the Portland Cement Association, has resigned to take up private practice. F. R. McMillan, manager, structural and technical bureau of the association, has been appointed director of research, to succeed Professor Abrams.

C. L. MCARTHUR, formerly chief technologist for the F. X. Baumert Co., Inc., cheese manufacturers, has joined the staff of Arthur D. Little, Inc., Cambridge, Mass. Mr. McArthur spent several years in the capacity of research bacteriologist for the government and was at one time head of the department of bacteriology of the University of Arkansas.

Dr. LESTER A. PRATT, director of research of the Merrimac Chemical Company, has assumed the duties of manager of the Anderson Chemical Company division of the Merrimac Chemical Co.

W. S. WILSON, formerly director of plant development, has become director of research for the Merrimac Chemical Co.

WALTER MILLER, vice-president of the Marland Refining Co., has been appointed vice-chairman in charge of the refining section of the A.I.M.E.

Dr. E. P. CLARK has been selected by the Interstate Cottonseed Crushers Association to start the program of basic research that has been under consideration for the past five or six years. Dr. Clark will conduct his investigations in the laboratories of the Bureau of Chemistry, and will have the co-operation of the entire staff of government investigators.

C. GORDON MILBOURNE, formerly engaged in research on water gas at the experimental station of E. I. duPont deNemours and Co., Henry Clay, Del., has resigned to enter upon graduate study and research in the department of gas engineering, Johns Hopkins University. Mr. Milbourn is a graduate of that university, receiving the B.S. degree in 1925. His advanced study is made possible by a gift for research donated to the department of gas engineering by Rufus C. Dawes of Chicago in co-operation with the Mobile Gas Company.

WILLIAM H. WAGGAMAN has accepted a position as technologist with The G. Ober and Sons Fertilizer Co. of Baltimore. Mr. Waggaman will, however, also continue work as a consultant for other industrial groups in the development of the fuel-fired furnace process for producing phosphoric acid.

C. H. CHRISTMAN, who has spent the past seven years as research chemist with the Clinton Corn Syrup Refining Co., has resigned to undertake research work in the laboratory of the Chicago Chemical Co., manufacturers of K.W.S. sodium aluminate.

VERNE W. UKER has accepted a position as refinery engineer with the Champlin Refining Co. of Enid, Okla. Mr. Uker is a graduate of Iowa State College, and was formerly employed as assistant engineer for the Skelley Oil Co. at its El Dorado, Kansas, refinery.

E. W. GUERNSEY has resigned from the Fixed Nitrogen Research Laboratory to join the research department of the Consolidated Gas, Electric Light and Power Co. of Baltimore.

A. W. ALLEN, formerly Western editor of *Chem. & Met.*, has returned to New York from Chile where he spent a year in the nitrate fields. At present he is engaged in investigational work for his clients.

Obituary

Dr. Remsen

The death of Dr. IRA REMSEN at Carmel, California, on March 5, removed the last member of that group of splendid scholars that gathered about Dr. Daniel C. Gilman in 1876 to organize the Johns Hopkins University as an institution for the training of men in research and for the prosecution of research in a wide variety of fields. Born in New York City, N. Y., Feb. 10, 1846, Remsen received his fundamental, academic and professional education in institutions of his native city, securing his A.B. degree from the College of the City of N. Y. in 1865 at the age of 19, and his M.D. from the College of Physicians and Surgeons in 1867. Going abroad for further advancement through study and travel he especially cultivated chemistry at Tübingen and Göttingen, receiving the Ph.D. from the latter university in 1870. After serving as an assistant in Germany he accepted appointment as professor of chemistry, with physics attached, at Williams College, where he taught and conducted researches until he joined the staff of the Johns Hopkins.

Here, from 1876 until his retirement in 1913, Dr. Remsen led a most active life as teacher, executive, investigator, author and editor. He was professor of chemistry throughout all this period of 37 years; director of the chemical laboratory, 32 years; secretary of the Academic Council, 14 years, and president of the Johns Hopkins University from 1901 to 1912. He was an eminent member of that group of chemists, Eliot, Crafts, Noyes, Smith and Venable, who as executive heads of a series of our most important universities on the Atlantic coast, injected a new efficiency and new educational ideals into university administration.

Dr. Remsen wrote seven different textbooks on various phases of chemistry, which had a wide vogue and exerted much influence on many students. A notable achievement, for which he has been held in high esteem, was his founding in 1879 of the *American Chemical Journal*, for this did much to foster chemical research in this country through providing chemists with a medium for publication which they then lacked, and it brought recognition of the work of American chemists from the chemists of other countries. He edited this journal through 50 volumes until, in 1914, it was consolidated with the *Journal of the American Chemical Society*. The story of the origin and career of this journal is told by Remsen in his felicitous manner on pages 495-496 of Volume 50.

Though he ventured to other phases, as in his study of "chemical action in magnetic fields" and the "barking of sails," Remsen practically specialized in organic chemistry. He is widely known among chemists by the long continued study of sulphonic acids as presented in many papers from his laboratory. He enjoyed a wider popularity because of the discovery of the synthetic compound saccharin.

It is of interest that, though Remsen was a "pure scientist," never touching "applied science" except to some extent as a consultant and expert witness, he was, in 1904, awarded its medal for services in advancing applied chemistry, by the Society of Chemical Industry, and, in 1910 he was elected its president. Sir William Ramsay pointed out that Remsen had served applied chemistry through the creation of a new industry in his discovery of saccharin,

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Ira Remsen

and in educating so many men who had rendered distinguished service in industrial chemistry.

Dr. Remsen received the Willard Gibbs medal in 1914, and in 1923 the Priestly medal, then awarded for the first time. He properly received wide recognition and had had a multitude of distinctions conferred upon him. He was an engaging personality, urbane, witty, considerate, but direct and decisive. A most vivid description of him, as he presided over the National Academy of Sciences, appears in the story of "The man that tipped the earth." CHARLES E. MUNROE.

BENJAMIN NIKOLAS BROIDO, chief engineer of the industrial department of the Superheater Company, New York and Chicago, died suddenly Feb. 10.

Calendar

AMERICAN REFRACTORIES INSTITUTE, Spring meeting, Atlantic City, N. J., May 18 and 19.

AMERICAN CHEMICAL SOCIETY, Richmond, Va., April 12-16, 1927.

AMERICAN ELECTROCHEMICAL SOCIETY, Philadelphia, April 27, 28 and 29.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, Cleveland, Ohio, May 31, June 1, 2, 3.

AMERICAN INSTITUTE OF CHEMISTS, conclave, Yale University, New Haven, Conn., March 28.

AMERICAN LEATHER CHEMISTS ASSN., annual meeting, Cincinnati, Ohio, June 15, 16 and 17.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS, spring meeting, White Sulphur Springs, W. Va., May 23 to 26.

NATIONAL ACADEMY OF SCIENCES. Annual meeting, Washington, D. C., April 25, 26 and 27.

NATIONAL COLLOID SYMPOSIUM, Ann Arbor, Mich., June 22 to 24.

NATIONAL EXPOSITION OF CHEMICAL INDUSTRIES, (11th) Grand Central Palace, New York, Sept. 26—Oct. 1.

Leland L. Summers

LELAND L. SUMMERS, consulting engineer of broad experience and wartime munitions adviser to J. P. Morgan & Co., died at his home in New York City on March 10. He was fifty-six years of age and up to within a few days of his death had been active in professional and consulting matters.

Early in the spring of 1917 Mr. Summers was called to Washington by his friend Bernard M. Baruch and there he served as technical adviser to the raw materials division of the Council of National Defense. In the summer of 1918 he was sent to Europe as chairman of the War Industries Board commission and he was immediately appointed a member of the Inter-Allied Munitions Council in Paris. Following the armistice he served with distinction as a member of the group of technical advisers to the American peace delegation. It was for these services during and following the war that Mr. Summers received the Distinguished Service Medal; France made him a member of the Legion of Honor, Belgium a commander of the Order of the Crown, and Italy an officer of the Order of the Italian Crown.

Several prominent chemical engineers and executives who were associated with Mr. Summers in France served as honorary pallbearers at his funeral in New York March 12. Among them were Charles H. MacDowell, March F. Chase, William P. Deppe, Alexander Legge and Bernard M. Baruch.

ALBERT BALL, chief engineer of the Sullivan Machinery Co., Chicago, Ill., with which he was connected for nearly fifty years, died Feb. 7 at his home in Claremont, N. H., 92 years of age.

Dr. LUIGI CASALE, the inventor of the Casale process for the production of synthetic ammonia, died Feb. 18 at Vagevano, near Milan, Italy.

ALBERT W. SMITH, professor of chemical engineering at Case School of Applied Science, died March 4 at Cleveland. Dr. Smith graduated from Michigan University, received a B.S. in 1887 from the Case School of Applied Science and Ph.D. in 1891 from the University of Zürich. Since 1891 he had been on the faculty of the Case School.

Industrial Notes

BAKELITE CORP., New York, is conducting a novel traveling exhibition of Bakelite in industry. The exhibition will include the products of over 200 manufacturers who make use of Bakelite in one form or another. The itinerary began at Columbus, Ohio on March 10 and will continue through the States of Ohio, Michigan, Indiana and Kentucky, ending at Cincinnati on May 7. Details can be obtained on application to the company.

H. P. MACGREGOR has resigned as Eastern Sales Manager for the Merco Nordstrom Valve Co. and has established himself as a manufacturers' agent in St. Louis, Mo. Mr. MacGregor is a graduate engineer of eight years general engineering experience and six years' sales experience. Engineering manufacturers desiring representation in the Missouri and South Illinois region can communicate with Mr. MacGregor at Room 310 Title Guarantee Bldg., St. Louis, Mo.

Market Conditions and Price Trends

Increasing Use of Chemicals in Pulp and Paper Trade

Liquid Chlorine Finds Enlarged Outlet With Falling Off in Demand for Bleaching Powder

WHILE increased production of news print in Canada in the last few years, has served to check the outturn of that product in this country, the manufacture of pulp and paper in general has shown up in a favorable light. According to data collected in the census of manufactures, total output of paper in the United States in 1925 was 9,182,204 tons which represents an increase of 14.4 per cent over the total production for 1923. Production of pulp also was on a larger scale as is shown in Table I which gives the totals for 1925 and 1924.

Table I—Domestic Production of Pulp

Process	Tons 1925	Tons 1924
Mechanical	1,629,689	1,643,283
Sulphite	1,447,191	1,336,551
Soda	472,647	440,697
Sulphate	412,690	302,735
Totals	3,962,217	3,723,266

Demand for chemicals and related products, in the pulp and paper trade, has increased very much in proportion to the growth in the output of the finished products.

In Table II figures are given to indicate consumption of some of the more important chemicals in the manufacture of pulp and paper for 1924, 1925, and 1926. In the case of rosin the figures for 1924 and 1925 are based on data compiled by the Bureau of Chemistry. Other figures as given in the table are estimates based either on private data or on calculations into which the process of manufacture employed and the volume of output enter.

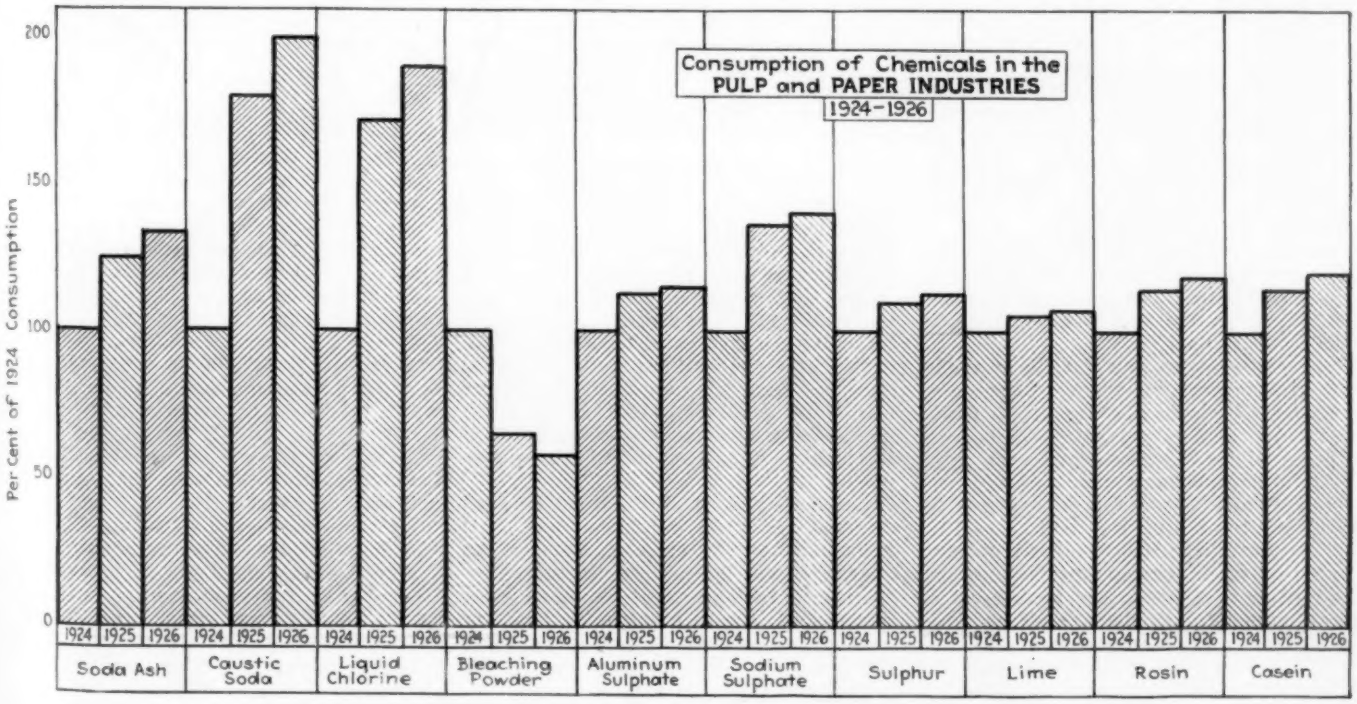
The principal use for sulphur in the pulp and paper industry is in the manufacture of sulphite pulp. For each short ton of pulp about 250 lb. of sulphur is required. Census figures give sulphite pulp production in 1925 as 1,447,191 short tons. Hence a little more than 180,000 tons of sulphur would enter into pulp production during that year which added to other outlets would bring total sulphur consumption in the pulp and paper trade in 1925 to about 230,000 short tons. The figure for 1926 is estimated on the same basis with allowance for a larger output for sulphite pulp, no official figures being available.

Sodium sulphate consumption is estimated on a basis of 500 lb. of sulphate to each ton of sulphate pulp. Production of the latter in 1925 was 412,690 tons which would represent a content of 103,000 tons of sodium sulphate. Of the total casein supply, domestic production plus imports, nearly 80 per cent goes into manufacture of paper.

Liquid chlorine production is estimated as slightly more than 60,000 tons of which about 65 per cent goes into pulp and paper. The balancing figure which is required to represent total chroline consumption in the pulp and paper trade is credited to bleaching powder with an average content of 35 per cent chlorine. It will be noted that demand for liquid chlorine has been increasing whereas consumption of bleaching powder has been declining. The decline is all the more pronounced because each ton of liquid chlorine replaces nearly three tons of bleaching powder.

Table II—Consumption of Chemicals in Pulp and Paper Manufacture

	1924 Tons	1924 Per Cent of 1924	1925 Tons	1925 Per Cent of 1924	1926 Tons	1926 Per Cent of 1924
Soda ash	60,000	100	75,000	125	80,000	133
Caustic soda	5,000	100	9,000	180	10,000	200
Liquid chlorine	21,000	100	36,000	171	40,000	190
Bleaching powder	90,000	100	57,000	64	51,000	57
Aluminum sulphate	87,500	100	99,000	113	102,000	115
Sodium sulphate	75,600	100	103,000	136	106,000	140
Sulphur	210,000	100	230,000	110	240,000	114
Lime	280,000	100	295,000	105	300,000	107
Rosin	68,000	100	78,000	115	81,000	119
Casein	14,500	100	16,500	115	17,500	121



Market Conditions and Price Trends

Consuming Demand for Chemicals and Related Products Increases

Deliveries from Producing Centers Larger Than in Preceding Month But Smaller Than a Year Ago

BOTH production and consumption of chemicals and allied products has been on an increasing scale from the middle of January. General business is estimated to have gained more than 10 per cent in volume in February, as compared with the preceding month. Industrial operations in the current month also have been of an expanding nature and the chemical industry has moved in harmony with general business.

The comparison is less favorable when referred to the corresponding periods of 1926 as activities both with reference to general industry and the chemical trade are estimated at about 5 per cent below the scale of last year's operations.

Fertilizers Depressed

The year opened with unfavorable prospects confronting the fertilizer trade. The largest consumption of fertilizers and fertilizer materials is in the southern states. The cotton situation made practically certain a curtailment of acreage in the coming season and the reduced buying power of planters warranted belief that the decline in fertilizer consumption would be greater proportionately than the curtailment of the cotton acreage. The accuracy of these calculations has been evidenced by reports of tag sales for fertilizers which for February were only 62.3 per cent of the total reported for February, 1926. Improvement has been reported since March 1, but it is held in some quarters that fertilizer sales for the present year will be at least 25 per cent below those for last year.

Conditions in the fertilizer trade are reflected in production and consumption of sulphuric acid especially in the southern part of the country. The output of acid phosphate in January was more than 18 per cent below the production in January, 1926. With a smaller production of fertilizers, the demand for such materials as nitrate of soda, sulphate of ammonia, and potash salts necessarily will not come up to the levels of last year.

In contrast to the fertilizer trade, other industries which are large consumers of chemicals are in a fairly normal condition and unless business is depressed by the threatened coal strike or by other contingencies, a steady production and consumption appears in prospect for the spring months.

The tire industry has been gaining rapidly with current production reported to be close to the peak level of last summer. Production of polished plate glass in January was 8,483,863 sq.ft., an increase of 15.5 per cent over December, 1926, but a decrease of 20.9 per cent from January, 1926. Building operations, while restricted as far as office buildings, hotels and apartment houses are concerned, have been going forward for other types of construction and building permits for 25 of the leading cities of the country for February reported a gain of 25 per cent in valuations over the total for the corresponding month of last year.

Stocks of hides and leather were reduced in January and basic conditions in the tanning trade have improved considerably so that an increased call for tanning materials seems logical this year. The textile industry, likewise, is more active in some branches than was the case a year ago. Based on employment figures, however, activities in dyeing and finishing textiles, have not been up to the levels reported at the corresponding period last year.

Manufacturing Indexes

According to indexes of production as compiled by the Department of Commerce the output of raw materials was smaller in January than in December but greater than a year ago, increases over January, 1926, being registered in all groups except forest products, which declined. Manufacturing production, after adjustment for differences in working time, showed no material change from the previous month but was lower than a year ago. As compared with last year, all groups were lower except textiles, nonferrous metals, leather, chemicals and oils, and tobacco, which showed increases. As compared with the previous month, decreased activity was registered in textile, lumber, leather, chemicals and oils, and stone and clay products, other groups showing increases.

Stocks of commodities held at the end of the month after adjustment for seasonal conditions were lower than in December, 1926. Stocks of raw foodstuffs, although showing lower holdings than in the preceding month, were larger than a year ago, while other raw materials for manufacture showed larger stocks than in either prior period. Stocks of manufactured foodstuffs were smaller than in either the previous month or January, 1926, while other manufactured commodities were held in larger quantities than in either period.

Unfilled orders for manufactured commodities, principally iron and steel and building materials, showed no change from the preceding month, a decline in the index for iron and steel being offset by an increase in building materials. As compared with last year, the index of unfilled orders was lower, each group showing the same trend.

Indexes of Employment

Industrial operations in January as measured by the weighted index of employment prepared by the Bureau of Labor would indicate a slight falling off in chemical production as compared with December but a gain over January, 1926. Gains over the preceding January also are shown in the leather and petroleum refining industries with unfavorable comparisons for the other industries named. The indexes of employment after the following comparisons with December, and February, 1926.

Weighted Index of Employment

	Jan. 1927	Dec. 1926	Jan. 1926
Dyeing and finishing textiles	98.2	98.7	101.4
Leather	93.0	92.4	92.6
Paper and pulp	94.4	94.4	95.1
Chemicals	96.1	96.4	95.3
Fertilizers	97.0	89.4	107.4
Glass	89.7	98.6	95.1
Automobile tires	102.4	101.9	112.6
Petroleum refining	101.9	101.1	97.6

Gains in Export Trade

The United States exports of chemicals and allied products advanced 17 per cent from $13,470,000 in January, 1926, to $15,817,000 in January, 1927, while the imports declined 18 per cent from $21,639,000, to $17,630,000. Only two of the major groups, crude drugs and explosives, were on the minus side of the export trade, but nearly all were on that side of the import trade, the exceptions having been coal-tar products, medicinal and pharmaceutical preparations, paints, and soaps and toilet preparations.

During January, both outgoing and incoming shipments of coal-tar products were high and almost balanced, $1,931,000 for the former, and $1,910,000 for the latter. In the exports, foreign sales of crudes, benzol, and crude coal-tar pitch and tar, were exceptionally large, amounting to nearly 2,000,000 gal., worth $550,000, and 150,000 bbl., worth $800,000, respectively.

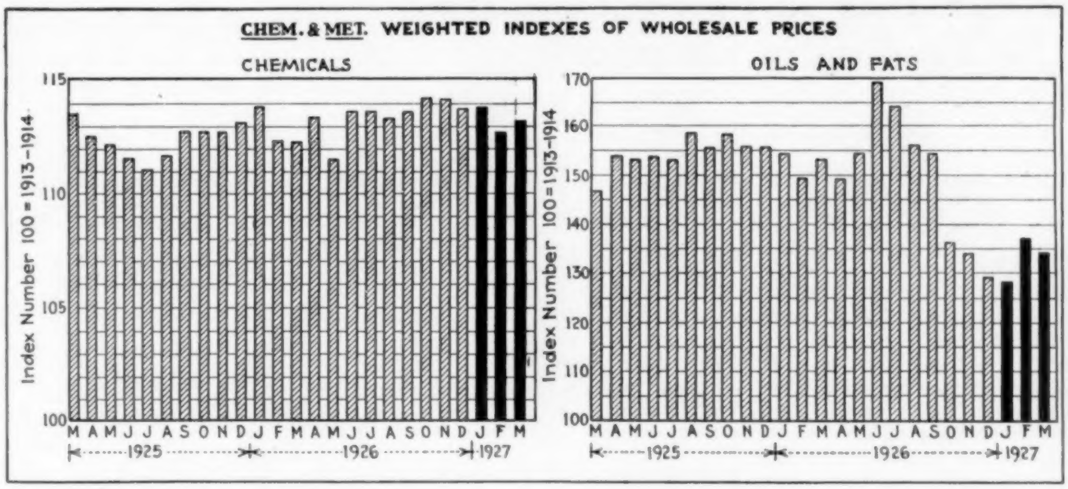
Imports of creosote again accounted for over half of all coal-tar imports or $1,000,000. Coal-tar colors, dyes, and stains recorded about 300,000 lb. more exported the current January, than in January of last year although the value was slightly less. Imports of dyes were likewise more and equaled 516,000 lb.

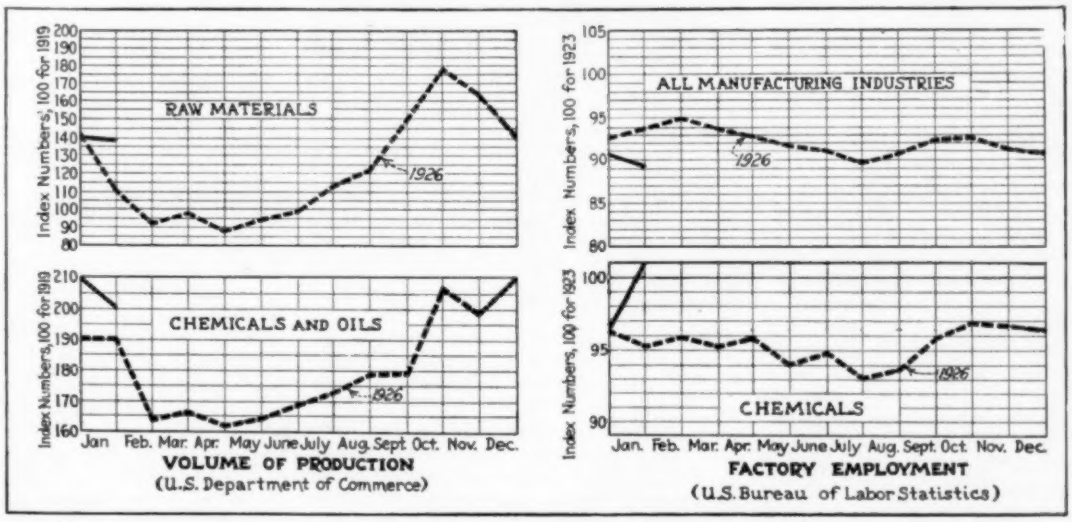
Industrial chemicals showed a 23 per cent advance in exports of $2,758,000 in January, 1927, over January, 1926, but imports of $2,659,000 a one per cent decrease. There was a general upward tendency in exports and downward in imports of the majority of chemicals of this group, methanol being the biggest exception with exports small and imports large.

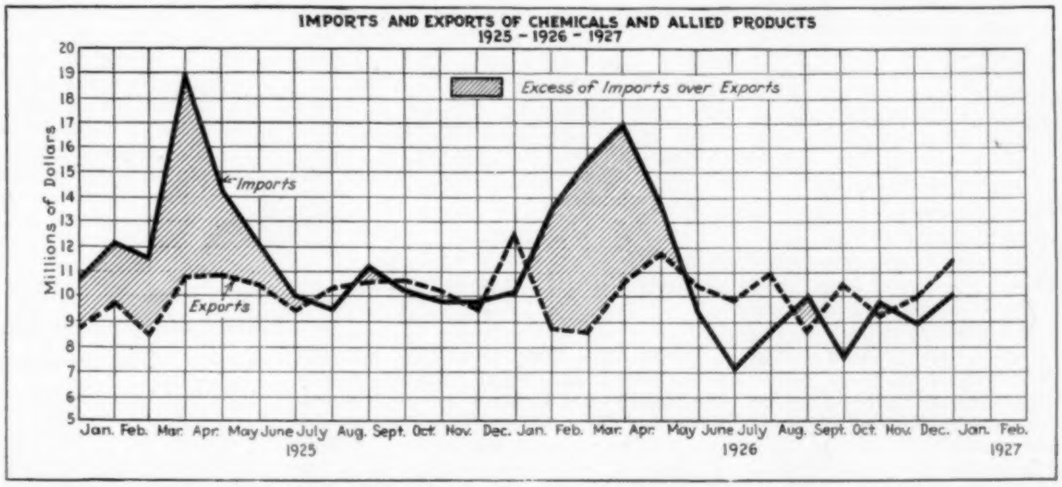
On the import side, glycerin fell back somewhat from the large amounts having been purchased from foreign countries during the past year or so when only 1,078,000 lb. of crude, and 921,000 lb. of refined was received. No citric acid or citrate of lime entered the country during the month.

CHEM·&MET· Statistics of Business

In the Chemical Engineering Industries







Market Conditions and Price Trends

Irregularity in Prices Features Trading in Chemicals

Strong Position of China Wood Oil Stands Out in Market for Vegetable Oils and Fats

WHILE there was an irregularity in prices for chemicals during the past month, there was no decided trend in either direction. The weighted index number settled at 113.09 which shows a gain over the weighted number for the preceding month. The change, however, was influenced by price movements among the chemicals of smaller tonnage. The index number also does not take into account the easier tone in some chemicals where quoted prices were unchanged but where buyers on firm bids undoubtedly could have shaded the openly named figures.

Values for vegetable oils and fats fluctuated considerably during the period. Crude cottonseed oil at one time reached the highest level of the present crop year and carried competing oils and fats into higher ground. A recession then set in and at the latter part of the month under review and the price tendency at the close appeared to be downward. China wood oil furnished a sharp contrast to the general market inasmuch as it was influenced by conditions at primary points. The political situation in China has made it difficult to bring oil down the river to Hankow or to other terminals and while large stocks are held in the interior they are not available for shipment. Hence the shipment market has been nominal and record prices have been obtained on sales in the spot market. The weighted index number for oils and fats is 134.38 as compared with 137.14 a month ago and 152.43 a year ago.

Considerable interest in the alcohol trade was created during the month by the arrival of 2,800,000 gal. of molasses from Holland and Poland. This was consigned to a company prominent in the manufacture of alcohol. Conjecture arose regarding the possibility of competition between European and Cuban suppliers of molasses but it was generally admitted that prices were too much in favor of the Cuban product to encourage hopes of developing a new source of supply.

Oxalic acid has been free from competitive selling. Foreign producers have curtailed shipments to this country and unusual demand has arisen for domestic makes. Producers have used their output to take care of existing orders and there have been no surplus holdings to weaken the position of the market. Underlying conditions would seem to warrant an advance in price but producers appear content at present levels and apparently do not care to give any incentive to foreign shippers to increase their outlets in domestic markets.

Prussiate of soda has been marked in recent months by a very limited competition from foreign countries. Domestic production took care of a large part of home needs in 1926 but, from present indications, it will strengthen its position as a supplier in the present year. In the latter part of last year contract prices were placed at a figure which put foreign producers at a disadvantage. Spot prices, while higher than those granted to contract buyers, appear to be low enough to discourage importations and the indication in that the loss in import trade has been made up by a larger domestic production.

Contract deliveries of caustic soda and soda ash since the first of the year have been variously reported by producers. In some cases deliveries are said to have fallen considerably below the totals for the corresponding period of last year while other reports indicate a gain in shipments. The difference in activities on the part of producers is said to be due to the keen competition which prevailed during the active contract period. Low prices named in some quarters were not met by some producers and as a result there is said to be a disproportionate division of the trade which may have an effect later on, in the market for related chemicals.

Leading Market Developments During the Month

Decision in barium dioxide case upholds constitutionality of flexible provisions of Tariff act.

European shipments of methanol to this country in December and January were the largest on record.

Inability to move stocks of wood oil from interior points in China followed by peak prices in domestic markets.

Competition for contract business in alkalies is reported to have resulted in unequal division of consuming trade among producers.

Cost data on production of sodium silica fluoride has been compiled and public hearing may soon be called by Tariff Commission.

Kauri Gum Under Direction of Board of Control

Early last year the New Zealand government passed an act known as the Kauri Gum Control Act which provided for the control of the gum industry both as regards marketing and production. It was intended to make the act operative by April 1, 1926, but there were delays in organizing the board and it had not begun to function by the end of the year. Recent advices to the Department of Commerce have stated that further delay has occurred pending the election of members of the board, although revised plans had called for control of the industry on December 1.

Higher Duty Fails to Check Imports of Methanol

Although an import duty of 18c. per gal. became effective in December, arrivals of methanol from foreign markets did not seem to be affected by the rise from the 12c. per gal. impost. Preliminary figures gave imports in December as 31,551 gal. but this figure was found to be in error and corrected figures give total arrivals for that month as 201,525 gal. valued at $93,249. The latter figure did not include some methanol which arrived after the higher duty went into effect and this quantity was added to the returns for January, thus giving total imports for that month as 312,196 gal. valued at $140,810. This represents an average value of slightly more than 45c. per gal. which with the addition of 18c. per gal. duty would easily permit of underselling domestic producers. That competition in pure methanol has been keen is shown by the fact that the domestic product has been subjected to price cutting in order to influence sales.

Production of crude methanol in the United States in January was reported at 755,473 gal. which compares with 733,678 gal. in December and 752,292 gal. in January, 1926. Production in Canada in January was 46,335 gal. as compared with 45,917 gal. in January, 1926. Domestic production of acetate of lime in January was 14,180,664 lb. which represents an increase over operations in December although it is a little below the output for January, 1926. Shipments of acetate of lime, however, were relatively small and the stocks on hand at the close of January had advanced to 22,196,923 lb.

Generally considered, recent developments in the wood distillation industry can hardly be construed in a favorable light. If importations of methanol are to continue in anything like the volume reported for December and January it is probable that the foreign-made product will supply a much larger proportion of domestic consuming requirements than was the case last year. This should mean a corresponding decline in sales of domestic methanol.

Increased Production and Use of Sal Ammoniac

Official figures for imports of sal ammoniac in 1926 were reported at 15,811,876 lb. This represents an increase of nearly 44 per cent over the arrivals in 1925. The increase in offerings from abroad is indicative of a larger consumption in domestic indus-

Market Conditions and Price Trends

Chem. & Met. Weighted Index of Chemical Prices

Base = 100 for 1913-14

This month	**113.09**
Last month	112.79
March, 1926	112.08
March, 1925	113.16

Irregular prices have been found in the market for chemicals. Basic chemicals were quotably unchanged. Denatured alcohol, pure methanol, and benzol were easy but higher prices held for tin salts, nitrate of soda, and sulphide of soda.

Chem. & Met. Weighted Index of Prices for Oils and Fats

Base = 100 for 1913-14

This month	**134.38**
Last month	137.14
March, 1926	152.43
March, 1925	146.75

Lower prices are now reported for most vegetable oils and fats. The advance in cottonseed oil earlier in the period has been nullified by recent declines. Linseed oil shows net losses but a very strong market has ruled for China wood oil.

tries as a material gain has been recorded in domestic production and it is probable that still further gains in production will be made in the present year owing to plans of new producers to enter the field. The supply of foreign-made sal ammoniac available for domestic consumption in recent years is apparent from the import data which is as follows for the years enumerated:

Imports of Sal Ammoniac

	Lb.	Value
1926	15,811,876	$617,191
1925	10,990,274	462,129
1924	9,791,100	453,783
1923	6,056,902	325,179
1922	6,647,610	338,555
1921	4,638,275	271,398
1920	5,295,692	563,130

The above valuations refer to amounts as shown of consular invoices. Landed prices would include duty at the rate of 1¼c. per lb. from October, 1922, through 1926, and of ¾c. per lb. for the time preceding October, 1922.

Domestic production of sal ammoniac has not been given separately in recent census returns but for earlier years was as follows:

Domestic Production of Sal Ammoniac

	Lb.	Value
1921	14,339,147	$1,069,102
1919	13,212,619	1,565,340
1914	11,511,934	641,040

In 1914 it was estimated that domestic consumption of sal ammoniac was a little more than 20,000,000 lb., of which 9,254,539 lb. was imported. The rapid increase in demand for sal ammoniac in the battery trade has greatly enlarged total consumption of sal ammoniac. It is estimated that battery requirements at present run about 33,000,000 lb. per year and that domestic production of the chemical has increased to approximately 35,000,000 lb. per year.

Development of sal ammoniac production in this country has been along logical lines following the introduction of synthetic ammonia, which is one of the important raw materials required for making sal ammoniac. Producers of ammonia have found difficulty in disposing of stocks and the opportunity to convert some of surplus holdings into sal ammoniac undoubtedly has proved attractive and import figures offer proof that domestic production still falls short of consuming needs. Import figures also reveal that foreign producers supply considerable tonnage of ammonium carbonate and bicarbonate, ammonium nitrate, ammonium perchlorate, and ammonium phosphate. This puts this country in the position of having a large surplus supply of ammonia and of importing considerable quantities of this material in the form of ammonium salts.

Germany is supplying the greater part of foreign-made sal ammoniac and the bulk of importations consist of the white variety. Domestic producers of gray sal ammoniac are practically free from outside competition but the price for domestic gray is below the price for domestic white for the first time in the history of the industry.

Acid Manufacturers Cut Down Requirements for Sulphur

Reports from southern manufacturers of sulphuric acid indicate that they are finding a smaller outlet for their product than was the case a year ago. The fertilizer trade is expected to show a contraction of more than 20 per cent in operations this year and this would mean a corresponding narrowing of acid production which in turn would be reflected in the demand for sulphur. Official figures recently were issued by the Department of Commerce which place the production of sulphur in 1926 at 1,890,057 long tons, compared with 1,409,262 long tons in 1925, an increase of 34 per cent. The salient feature of the sulphur industry in 1926, however, according to this report, was the record-breaking shipments, which totaled 2,072,687 tons, valued at approximately $37,300,000, compared with 1,858,003 tons, valued at approximately $29,000,000 in 1925, the previous record year. Production figures were second only to those of 1923 and, while still about 183,000 tons less than shipments, were closer than they had been since the closing down of the sulphur mine in Louisiana, in 1924. Over 99.9 per cent of the production was made by two companies in Texas, while over 99.9 per cent of the shipments was made by these companies and the company in Louisiana which is still shipping from stocks. The record shipments of sulphur and the reduced rate of exportation in 1926 indicate record-breaking domestic consumption in that year. Stocks at the mines were reduced to 2,060,000 long tons at the end of the year.

Exports of sulphur or brimstone from the United States totaled 576,966 tons in 1926, valued at $10,918,580, of which 159,416 tons were exported to Canada, 108,477 tons to Germany, 91,735 tons to France, 66,507 tons to Australia, 27,340 tons to the United Kingdom, and 26,618 tons to New Zealand. Exports of refined, sublimed, and flowers of sulphur totaled 12,002,105 pounds, valued at $236,146, exported mainly to Canada, Mexico, France, and Australia. In 1925 the exports of sulphur or brimstone amounted to 629,401 tons and the exports of refined, sublimed, and flowers of sulphur amounted to 6,381,791 pounds. The exports in 1926 were second only to the record exports of 1925. Imports of sulphur and sulphur ore for consumption for 9 months of the year amounted to 48 long tons and imports of sulphur in other forms for 9 months amounted to 160 tons.

The output of pyrites in 1926 was practically at the same rate as in 1925, decreasing from 170,081 long tons, valued at $650,448, in 1925 to 166,559 tons, valued at $616,668, in 1926, or a decrease of 2 per cent in quantity. The quantity sold or consumed by the producing company showed a larger decrease, from 170,298 long tons in 1925 to 163,217 tons in 1926. California and Virginia produced 95 per cent of the total output and New York and Ohio supplied the remainder.

Imports of pyrites in 1926 showed an increase of 32 per cent in quantity over 1925, from 276,385 tons, valued at $773,925, to 366,151 tons, valued at $856,981, and were the largest recorded since 1919. Of the total quantity imported Spain furnished 365,103 tons and Canada the remainder.

Imports of Synthetic Dyes Decline in Volume

According to official government figures, imports of synthetic dyes into this country for the first two months of the year were 508,897 lb. compared with 629,486 lb. in the corresponding period of 1926. In February, imports were 312,277 lb., of which 298,919 lb. entered at New York and 13.358 lb. at Boston. The five leading dyes, by quantity, imported in February were:

Helindone printing black R.D. paste	25,000 lb.
Rhodamine B extra, single strength	13,200 lb.
Ciba red, R paste	12,566 lb.
Cibanone orange R, single strength	8,876 lb.
Vat olive R, single strength	8,705 lb.

Current Prices in the New York Market

For Chemicals, Oils and Allied Products

The following prices refer to round lots in the New York Market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to March 14.

Industrial Chemicals

		Current Price	Last Month	Last Year
Acetone, drums	lb.	$0.12 -$0.13	$0.12 -$0.13	$0.12 -$0.13
Acid, acetic, 28%, bbl.	cwt.	3.38 - 3.63	3.38 - 3.63	3.25 - 3.50
Boric, bbl.	lb.	.08½- .08¾	.08½- .08¾	.08½- .11
Citric, kegs	lb.	.43½- .44½	.44½- .47	.45½- .47
Formic, bbl.	lb.	.10½- .11	.10½- .11	.10 - .10½
Gallic, tech., bbl	lb.	.50 - .55	.50 - .55	.45 - .50
Hydrofluoric 30% carb.	lb.	.06 - .07	.06 - .07	.06 - .07
Lactic, 44%, tech., light, bbl.	lb.	.13½- .14	.13½- .14	.13½- .14
22%, tech., light, bbl.	lb.	.06½- .07	.06½- .07	.06½- .07
Muriatic, 18°, tanks	cwt.	.85 - .90	.85 - .90	.85 - 90
Nitric, 36°, carboys	cwt.	.05 - .05½	.05 - .05½	.05 - .05½
Oleum, tanks, wks.	ton	18.00 -20.00	18.00 -20.00	16 00- 17.00
Oxalic, crystals, bbl.	lb.	.11 - .11½	.11 - .11½	.10½- .11
Phosphoric, tech., c'bys.	lb.	.07 - .07½	.07 - .07½	.07½- .08
Sulphuric, 60°, tanks	ton	10.50 -11.00	10.50 -11.00	8.50 - 9.50
Tannic, tech., bbl	lb.	.35 - .40	.35 - .40	.45 - .50
Tartaric, powd., bbl.	lb.	.31½- .32	.29½- .30	.27½- .30
Tungstic, bbl.	lb.	1.00 - 1.20	1.00 - 1.20	1.00 - 1.20
Alcohol, ethyl, 190 p'f. U.S.P. bbl	gal.	4.92½- 5.00	4.90½- 5.00	4.94 - 5.04
Alcohol, Butyl, dr.	lb.	.20½- .21	.19½- .19½	.19 - .20
Denatured, 190 proof No. 1 special dr.	gal.	.33 - .35	.31 - .36	.36 -......
No. 5, 188 proof, dr.	gal.	.33 - .35	.31 - .33	.36 -......
Alum, ammonia, lump, bbl.	lb.	.03½- .04	.03½- .04	.03½- .04
Chrome, bbl.	lb.	.05½- .05¾	.05½- .05¾	.05½- .06
Potash, lump, bbl.	lb.	.02¾- .03½	.02¾- .03½	.02¾- .03½
Aluminum sulphate, com., bags	cwt.	1.40 - 1.45	1.40 - 1.45	1.40 - 1.45
Iron free, bg.	cwt.	2.00 - 2.10	2.00 - 2.10	2.40 - 2.45
Aqua ammonia, 26°, drums.	lb.	.02¾- .03	.02¾- .03½	.03½- .04
Ammonia, anhydrous, cyl.	lb.	.11 - .13	.11 - .15	.15 - .17
Ammonium carbonate, powd. tech., casks	lb.	.10½- .14	.10½- .14	.11 - .14
Sulphate, wks.	cwt.	2.50 -......	2.50 -......	2.90 -......
Amylacetate tech., drums.	gal.	2.15 - 2.20	2.15 - 2.20	2. 30- 2.40
Antimony Oxide, bbl.	lb.	.16½- .17	.16½- .17	.18½- .19
Arsenic, white, powd., bbl.	lb.	.03½- .04½	.03½- .04½	.03¾- .04½
Red, powd., kegs.	lb.	.10¾- .11	.10¾- .11	.12 - .12½
Barium carbonate, bbl.	ton	47.00 -50.00	47.00 -50.00	43.00 -45.00
Chloride, bbl.	ton	60.00 -65.00	62.00 -65.00	58.00 -60.00
Nitrate, cask	lb.	.07¾- .08	.07¾- .08½	.07½- .08
Blanc fixe, dry, bbl.	lb.	.04 - .04½	.04½- .04	.03¾- .04
Bleaching powder, f.o.b., wks., drums	cwt.	2.00 - 2.10	2.00 - 2.10	2.00 - 2.10
Borax, bbl.	lb.	.04½- .04½	.04½- .05	.05 - .05½
Bromine, cs.	lb.	.45 - .47	.45 - .47	.45 - .47
Calcium acetate, bags	cwt.	3.50 -......	3.50 -......	3.25 - 3.50
Arsenate, dr.	lb.	.06½- .08	.06½- .07	.07 - .08
Carbide drums.	lb.	.05½- .06	.05½- .06	.05 - .05½
Chloride, fused, dr., wks.	ton	21.00 -......	21.00 -......	21.00 -......
Phosphate, bbl.	lb.	.07 - .07½	.07 - .07½	.07 - .07½
Carbon bisulphide, drums.	lb.	.05½- .06	.05½- .06	.06 - .06½
Tetrachloride drums	lb.	.06¾- .07	.06¾- .06½	.06½- .07
Chlorine, liquid, tanks, wks.	lb.	.04 - .04½	.04 - .04½	.04 - .04½
Cylinders	lb.	.05½- .08	.05½- .08	.05½- .08
Cobalt oxide, cans	lb.	2.00 - 2.10	2.10 - 2.20	2.10 - 2.25
Copperas, bgs., f.o.b. wks.	ton	15.00 -16.00	16.00- 18.00	13.50 -14.00
Copper carbonate, bbl.	lb.	.17 - .17½	.17 - .18	.17 - .18
Cyanide, tech., bbl.	lb.	49 - .50	.49 - .50	.49 - .50
Sulphate, bbl.	cwt.	4.80 - 4.90	4.80 - 4.90	4.50 - 4.60
Cream of tartar, bbl.	lb.	.22 - .22½	.22 - .22½	.21 - .22
Epsom salt, dom., tech., bbl.	cwt.	1.75 - 2.15	1.75 - 2.00	1.75 - 2.00
Imp., tech., bags	cwt.	1.15 - 1.25	1.15 - 1.25	1.35 - 1.40
Ethyl acetate, 85% drums.	gal.	.74 - .76	.74 - .76	.80 - .82
99%, dr.	gal.	1.03 -......	.95 - .96	1.03 - 1.08
Formaldehyde, 40%, bbl.	lb.	.11½- .11½	.11½- .11½	.09 - .09½
Furfural, dr.	lb.	15 - 17½	.15 - .17½	.20 - .23
Fusel oil, crude, drums.	gal.	1 35 - 1.40	1.40 - 1.50	1.80 - 1.90
Refined, dr.	gal.	2.50 - 3.00	2.50 - 3.00	3.10 - 3.20
Glaubers salt, bags	cwt.	1.00 - 1.15	1.00 - 1.10	1.20 - 1.40
Glycerine, c.p., drums, extra.	lb.	.27 - .27½	.28 - .29	.25 - .26
Lead:				
White, basic carbonate, dry, casks	lb.	.09½-......	.10½-......	.10¾-......
White, basic sulphate, sck.	lb.	.09¾-......	.09¾-......	.10 -......
Red, dry, sck.	lb.	.10¾-......	.11½-......	.12½-......
Lead acetate, white crys., bbl.	lb.	.14½- .15	.14½- .15	.14½-......
Lead arsenate, powd., bbl.	lb.	.14 - .15	.14 - .15	.14½- .15
Lime, chem., bulk	ton	8.50 -......	8.50 -......	8.50 -......
Litharge, pwd., csk.	lb.	.10½-......	.11 -......	.11¾-......
Lithopone, bags	lb.	.05½- .06	.05½- .06	.06 - .06½
Magnesium carb., tech., bags.	lb.	.07½- .08	.07½- .08	.06¾- .07
Methanol, 95%, dr.	gal.	.85 -......	.85 -......	.57 - .60
97%, dr.	gal.	.90 -......	.90 -......	.59 - .63
Nickel salt, double, bbl.	lb.	.10 - .10½	.10 - .10½	.09 - .10
Single, bbl.	lb.	.10½- .11	.10½- .11	.10 - .11
Orange mineral, csk.	lb.	.13 -......	.13¾-......	.14 -......
Phosphorus, red, cases	lb.	.62 - .65	.62 - .65	.68 - .70
Yellow, cases	lb.	.32 - .33	.32 - .34	.34 - .36
Potassium bichromate, casks.	lb.	.08½- .08½	.08½- .08¾	.08½- .08½
Carbonate, 80-85%, calc., csk.	lb	.05¾- .06	.06 -......	.06 - .06½
Chlorate, powd.	lb.	.08½- .09	.08½- .09	.08½- .09
Cyanide, cs.	lb.	.55 - .57	.55 - .58	52 - .54
First sorts, csk.	lb.	$0.09 -$0.09½	$0.08¾-$0.09	$0.08½-$0.08½
Hydroxide (c'stic potash) dr.	lb.	.07½- .07¾	.07½- .07¾	.07½- .07½
Muriate, 80% bgs.	ton	36.40 -......	36.40 -......	34.90 -......
Nitrate, bbl.	lb.	.06 - .06½	.06 - .06½	.06 - .07½
Permanganate, drums.	lb.	.14 - .15	.14 - .15	.14 - .15
Prussiate, yellow, casks	lb.	.18½- .19	.19 - .19½	.18 - .18½
Sal ammoniac, white, casks.	lb.	.05½- .06	.05½- .06¼	.05½- .06
Salsoda, bbl.	cwt.	.90 - .95	.90 - .95	1.10 - 1.20
Salt cake, bulk	ton	17.00 -18.00	17.00 -18.00	17.00 -19.00
Soda ash, light, 58%, bags, contract	cwt.	1.32½-......	1.32½-......	1.38 -......
Dense, bags	cwt.	1.37½-......	1.45 - 1.55	1.45 - 1.55
Soda, caustic, 76%, solid, drums, contract	cwt.	3.00 -......	3.00 -......	3.10 -......
Acetate, works, bbl.	lb.	.04½- .05½	.04½- .05	.04½- .05
Bicarbonate, bbl.	cwt.	2.00 - 2.25	2.00 - 2.25	1.75 - 2.00
Bichromate, casks	lb.	.06½- .06½	.06½- .06¾	.06½- .06¾
Bisulphate, bulk	ton	5.00 - 5.50	5.00 - 5.50	6.00 - 7.00
Bisulphite, bbl.	lb.	.03½- .04	.03½- .04	.04½- .04½
Chlorate, kegs	lb.	.06¼- .06½	.06¼- .06½	.06¾- .06½
Chloride, tech.	ton	12.00 -14.75	12.00- 14.75	12.00 -14.00
Cyanide, cases, dom.	lb.	.18 - .22	.18 - .22	.19 - .22
Fluoride, bbl.	lb.	.09½- .09¾	.09 - .09½	.09 - .09½
Hyposulphite, bbl.	lb.	2.50 - 3.00	2.50 - 3.00	.02½- .02½
Nitrate, bags	cwt.	2.65 -......	2.63 -......	2.42½-......
Nitrite, casks	lb.	.08½- .09½	.08½- .09	.09 - .09½
Phosphate, dibasic, bbl.	lb.	.03¼- .03½	.03½- .03¾	.03½- .03¾
Prussiate, yel. drums	lb.	.11 - .11½	.10¾- .10½	.10¾- .10½
Silicate (30°, drums)	cwt.	.75 - 1.15	.75 - 1.15	.75 - 1.15
Sulphide, fused, 60-62%, dr.	lb.	.03½- .04	.03 - .03½	.02¾- .03
Sulphite, crys., bbl.	lb.	.03 - .03½	.03 - .03½	.02½- .03
Strontium nitrate, bbl.	lb.	.08½- .09	.08½- .09	.09½- .10
Sulphur, crude at mine, bulk.	ton	19.00 -......	19.00 -......	15.00 -17.00
Chloride, dr.	lb.	.04 - .05	.04 - .05	.04 - .05
Dioxide, cyl.	lb.	.09 - .10	.09 - .10	.08½- .09
Flour, bag	cwt.	2.70 - 3.00	2.70 - 3.00	2.25 - 2.35
Tin bichloride, bbl.	lb.	.20 -......	.19¾-......	.16 -......
Oxide, bbl.	lb.	.70 -......	.70 -......	.61 -......
Crystals, bbl.	lb.	.47½-......	.47 -......	.39½-......
Zinc chloride, gran., bbl.	lb.	.06½- .06½	.07 - .08	.06 - .07½
Carbonate, bbl.	lb.	.10 - .11	.11 - .11½	.12 - .14
Cyanide, dr.	lb.	.40 - .41	.40 - .41	.40 - .41
Dust, bbl.	lb.	.10¾- .11	.10 - .10½	.08 - .08½
Zinc oxide, lead free, bag.	lb.	.06¾-......	.07½-......	.07¾-......
5% lead sulphate, bags	lb.	.06¾-......	.07 -......	.06¾-......
Sulphate, bbl.	cwt	3.00 - 3.10	2.75 - 3.00	3.50 - 3.75

Oils and Fats

		Current Price	Last Month	Last Year
Castor oil, No. 3, bbl.	lb.	$0.13¾-$0.14	$0.13 -$0.13½	$0.14½-$0.15
Chinawood oil, bbl.	lb.	.30 -......	.17½- .18	.13 - .13½
Coconut oil, Ceylon, tanks, N. Y.	lb.	.08½-......	.08¾-......	.10¼-......
Corn oil crude, tanks, (f.o.b. mill)	lb.	.08½-......	.08 -......	.09¼-......
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.07¾-......	.07¾-......	.09½-......
Linseed oil, raw, car lots, bbl.	lb.	10.3 -......	10.4 -......	11.2 -......
Palm, Lagos, casks	lb.	.08¾- .09	.08¾- .08½	.09 -......
Niger, casks	lb.	.08 -......	.07¾- .08	.08½-......
Palm Kernel, bbl.	lb.	.09¼-......	.09½-......	.10 - .10½
Peanut oil, crude, tanks (mill)	lb.	.12¼-......	.12¼-......	.10 -......
Perilla, bbl.	lb.	....-......	....-......	.14½-......
Rapeseed oil, refined, bbl.	gal.	.82 - .84	.79 - .80	.90 - .92
Sesame, bbl.	lb.	....-......	....-......	....-......
Soya bean tank (f.o.b. Coast)	lb.	.09½-......	.09½-......	.10¾-......
Sulphur (olive foots), bbl.	lb.	.09¾-......	.09¾-......	.09 -......
Cod, Newfoundland, bbl.	gal.	.63 - .66	.63 - .64	.64 - .65
Menhaden, light pressed, bbl.	gal.	.60 - .62	.60 - .62	.69 - .71
Crude, tanks (f.o.b. factory)	gal.	....-......	.45 -......	.55 -......
Whale, crude, tanks	lb.	....-......	....-......	....-......
Grease, yellow, loose	lb.	.07½-......	.06¾-......	.08¾- .08½
Oleo stearine	lb.	.11 -......	.08¾-......	.11¾-......
Red oil, distilled, d.p. bbl.	lb.	.09½- .10	.09½- .10	.11¾- .11½
Tallow, extra, loose	lb.	.07½-......	.07¾-......	.09½-......

Coal-Tar Products

		Current Price	Last Month	Last Year
Alpha-naphthol, crude, bbl.	lb.	$0.60 -$0.65	$0.60 -$0.65	$0.60 -$0.62
Refined, bbl	lb.	.85 - .90	.85 - .90	.75 - .80
Alpha-naphthylamine, bbl.	lb.	.35 - .36	.35 - .36	.35 - .36
Aniline oil, drums, extra	lb.	.15 - .16	.16 - .16½	.17 - .17½
Aniline salts, bbl	lb.	.24 - .25	.22 - .24	.20 - .22
Anthracene, 80%, drums	lb.	.60 - .65	.60 - .65	.65 - .70
Benzaldehyde, U.S.P., dr.	lb.	1.15 - 1.25	1.15 - 1.35	1.50 -......
Benzidine base, bbl.	lb.	.70 - .72	.70 - .75	.78 - .80
Benzoic acid, U.S.P., kgs.	lb.	.58 - .60	.58 - .60	.75 - .85
Benzyl chloride, tech, dr	lb.	.25 - .26	.25 - .26	.35 - .36
Benzol, 90%, tanks, works	gal.	.23 - .24	.25 - .28	.23 - .24
Beta-naphthol, tech., drums	lb.	.22 - .24	.22 - .24	.24 - .25
Cresol, U.S.P., dr.	lb.	.18 - .20	.18 - .20	.23 - .25
Cresylic acid, 97%, dr., wks.	gal.	.57 - .60	.59 - .63	.53 - .55
Diethylaniline, dr	lb.	.58 - .60	.58 - .60	.59 - .61
Dinitrophenol, bbl.	lb.	.31 - .35	.31 - .33	.35 - .38
Dinitrotoluen, bbl	lb.	.17 - .18	.17 - .18	.18 - .20
Dip oil, 25% dr	gal.	.28 - .30	.28 - .30	.26 - .28
Diphenylamine, bbl.	lb.	.45 - .47	.48 - .50	.48 - .50
H-acid, bbl.	lb.	.63 - .65	.63 - .65	.70 - .74

Coal-Tar Products—Continued

	Current Price	Last Month	Last Year
Naphthalene, flake, bbl..... lb.	$0.05¾–$0.06	$0.05¾–$0.06	$0.05 –$0.05½
Nitrobenzene, dr........... lb.	.09 – .10	.09 – .10	.09 – .10
Para-nitraniline, bbl........ lb.	.52 – .53	.45 – .50	.65 – .67
Para-nitrotoluine, bbl....... lb.	.28 – .32	.28 – .32	.40 – .42
Phenol, U.S.P., drums...... lb.	.17 – .19	.17 – .19	.23 – .25
Picric acid, bbl............ lb.	.30 – .40	.30 – .40	.25 – .26
Pyridine, dr............... lb.	3.00 –......	3.00 –......	4.10 – 4.20
R-salt, bbl................ lb.	.47 – .50	.40 – .44	.50 – .55
Resorcinal, tech, kegs....... lb.	1.30 – 1.35	1.35 – 1.40	1.30 – 1.40
Salicylic acid, tech., bbl..... lb.	.30 – .32	.30 – .32	.32 – .33
Solvent naphtha, w.w.,tanks gal.	.35 –......	.35 –......	.35 –......
Tolidine, bbl............... lb.	.95 – .95	.95 – .96	1.00 – 1.05
Toluene, tanks, works...... gal.	.35 –......	.35 –......	.26 –......
Xylene, com., tanks.. gal.	36 – .41	.36 – .41	.31 –......

Miscellaneous

	Current Price	Last Month	Last Year
Barytes, grd., white, bbl..... ton	$23.00–$25.00	$23.00–$25.00	$20.00–$22.00
Casein, tech., bbl.......... lb.	.15 – .16	.15 – .16	.13 – .14
China clay, dom.,f.o.b. mine ton	10.00 –20.00	10.00 –20.00	10.00 –20.00
Dry colors:			
Carbon gas, black (wks.).. lb.	.08 – .08½	.08 – .08½	.08 – .08½
Prussian blue, bbl........ lb.	.33 – .34	.33 – .34	.34 – .36
Ultramine blue, bbl....... lb.	.08 – .35	.08 – .35	.08 – .35
Chrome green, bbl........ lb.	.27 – .31	.28 – .30	.27 – .29
Carmine red, tins......... lb.	5.00 – 5.10	5.00 – 5.10	4.50 – 4.75
Para toner............... lb.	.80 – .90	.80 – .90	.90 – .95
Vermilion, English, bbl.... lb.	1.50 – 1.55	1.50 – 1.55	1.35 – 1.40
Chrome yellow, C. P., bbl. lb.	.17 – .18	.17½– .18	.18 – .19
Feldspar, No. 1 (f.o.b. N. C.) ton	6.50 – 7.00	6.00 – 6.50	5.50 – 6.00
Graphite, Ceylon, lump, bbl. lb.	.08 – .09	.07 – .09½	.08½– .09
Gum copal, Congo, bags..... lb.	.09½– .10	.09½– .10	.08 – .10
Manila, bags............ lb.	.15 – .18	.15 – .16	.14 – .16
Damar, Batavia, cases.... lb.	.25 – .25½	.25 – .26	.28½– .28¾
Kauri, No. 1 cases........ lb.	.55 – .57	.55 – .57	.58 – .62
Kieselguhr (f.o.b. N. Y.).... ton	50.00 –55.00	50.00 –55.00	50.00 –55.00
Magnesite, calc............ ton	44.00 –......	44.00 –......	40.00 –41.00
Pumice stone, lump, bbl.... lb.	.05 – .07	.05 – .08	.06 – .08
Imported, casks.......... lb.	03 – .40	.03 – .40	.03 – .35
Rosin, H................ bbl.	11.62 –......	12 25 –......	14.50 –......
Turpentine.............. gal.	.77 –......	.76 –......	1 10 –......
Shellac, orange, fine, bags... lb.	.47 – .48	.48 – .49	.72 – .73
Bleached, bonedry, bags... lb.	.50 – .52	.53 – .54	.59 – .62
T. N. bags.............. lb.	.42 – .44	.42 – .44	.48 – .49
Soapstone (f.o.b. Vt.), bags.. ton	10.00 –12.00	10.00 –12.00	9.00 –11.00
Talc, 200 mesh (f.o.b. Vt.)... ton	11.00 –......	11.00 –......	10.50 –......
200 mesh (f.o.b. Ga.)...... ton	7.50 –10.00	7.50 –10.00	7.50 –11.00
325 mesh (f.o.b. N. Y.).... ton	14.75 –......	14.75 –......	14.75 –....1
Wax, Bayberry, bbl......... lb.	.25 – .26	.25 – .26	.20 – .21
Beeswax, ref., light....... lb.	.45 – .46	.45 – .47	.40 – .42
Candelilla, bags.......... lb.	.33 – .34	.34 – .35	.30 – .31
Carnauba, No. 1, bags.... lb.	.65 – .70	.70 – .72	.37 – .38
Paraffine, crude 105-110 m.p.......... lb.	.05½– .06	.06 – .06¼	.06 –......

Ferro-Alloys

	Current Price	Last Month	Last Year
Ferrotitanium, 15-18%...... ton	$200.00–.....	$200.00–.....	$200.00–.....
Ferrochromium, 1-2%....... lb.	.23– .25	.23– .35	.24–.....
Ferromanganese, 78-82%.... ton	100.00–.....	88.00–90.00	115.00–.....
Spiegeleisen, 19-21%........ ton	36.00–37.00	36.00–37.00	32.00–.....
Ferrosilicon, 10-12%........ ton	33.00–38.00	33.00–38.00	33.00–38.00
Ferrotungsten, 70-80%...... lb.	1.05–.....	1.00– 1.05	1.14– ...
Ferro-uranium, 35-50%..... lb.	4.50–.....	4.50–.....	4.50–.....
Ferrovanadium, 30-40%..... lb.	3.15– 3.75	3.25– 4.00	3.25– 3.75

Non-Ferrous Metals

	Current Price	Last Month	Last Year
Copper, electrolytic......... lb.	$0.13¾–......	$0.12¾–......	$0.14 –$0.14¼
Aluminum, 96-99%......... lb.	.26 – .28	.26 – .27	.28 – .29
Antimony, Chin. and Jap.... lb.	.14¾–......	.14¾–......	.20½–......
Nickel, 99%............... lb.	.35 –......	.35 –......	.34 –......
Monel metal, blocks........ lb.	.32 – .33	.32 – .33	.32 – .33
Tin, 5-ton lots, Straits...... lb.	.69¾–......	69½–......	.65¾–......
Lead, New York, spot...... lb.	7.65 –......	7 30 –......	.08¾–......
Zinc, New York, spot....... lb.	7.10 –......	7.10 –......	.08¾–......
Silver, commercial.......... oz.	.56¾–......	.56¾–......	.69¾–......
Cadmium.................. lb.	.60 –......	.60 –......	.60 –
Bismuth, 508-lb. lots....... lb.	2.70 – 2.75	2.70 – 2.75	2.65 – 2.70
Cobalt.................... lb.	2.50 –......	2.50 –......	2.50 – 3.00
Magnesium, ingots, 99%.... lb.	.75 – .80	.75 – .80	1.00 –......
Platinum, ref.............. oz.	108.00–......	112.00–......	120.00–......
Palladium, ref............. oz.	68.00– 70.00	68.00– 69.00	78.00–......
Mercury, flask........... 75 lb.	104.00–......	102.00–	91.00–......
Tungsten powder........... lb.	1.05– 1 15	1.05–......	1.20–......

Ores and Semi-finished Products

	Current Price	Last Month	Last Year
Bauxite, crushed, wks....... ton	$5.50– $8.50	$5.50– $8.50	$5.50– $8.75
Chrome ore, c.f. post....... ton	21.00– 24.00	21.00– 24.00	18.50– 24.00
Coke, fdry., f.o.b. ovens..... ton	3.75– 4.25	3.75– 4.25	4.75– 5.00
Fluorspar, gravel, f.o.b. Ill.... ton	18.00–....	18.00–......	17.50– 18.50
Ilmenite, 52% TiO_2, Va..... lb.	.0⅝– .0¾	.0⅝ – .0¾	.01½–......
Manganese ore, 50% Mn., c.i.f. Atlantic Ports....... unit	.36 – .38	.36 – .38	.42 – .43
Molybdenite, 85% MoS_2 per lb. MoS_2, N. Y........... lb.	.48 – .50	.48 – .50	.60– .70
Monazite, 6% of ThO_2...... ton	120.00–......	120.00–......	120.00–......
Pyrites, Span. fines, c.i.f..... unit	.13½–......	.13½–......	.11½– .12
Rutile, 94-96% TiO_2........ lb.	.11 – .13	.11 – .13	.12 – .15
Tungsten, scheelite, 60% WO_3 and over....... unit	11.25 –11.50	11.25 –11.50	9.50 – 9.75
Vanadium ore, per lb. V_2O_5.. lb.	.25 – .28	.25 – .30	1.00 – 1.27
Zircon, 99% .... lb.	.03 –.....	.03 –.....	.06 – 05

Current Industrial Developments

New Construction and Machinery Requirements

Acetylene Welding Plant—Presto-O-Lite Co., 30 East 42nd St., New York, N. Y., plans the construction of an acetylene welding plant at Birmingham, Ala. Estimated cost $75,000. Private plans.

Asbestos Plant—H. W. Johns-Manville Co., Madison Ave. and 41st St., New York, N. Y., manufacturers of asbestos material, plans the construction of a plant at Kansas City, Mo. Estimated cost $350,000. Private plans.

Bottling Plant — Smack Beverage Co., 1925 Broadway, Fresno, Calif., (fruit juices) has acquired a site and plans the construction of a bottling plant at San Carlos, Calif.

Bottling Plant Equipment—Best & Bennett, Hamilton, Ont., is in the market for complete machinery for bottling plant. Estimated cost $50,000.

Brewery — Sarnia Brewing Co., Sarnia, Ont., will build an addition to plant. Estimated cost $75,000. Cooling equipment, bottling apparatus, vats, etc., will be required.

Brewery Machinery — H. O. Sleeman, Guelph, Ont., is in the market for machinery for new plant of Sleeman's Spring Bank Brewery Co. Ltd., Toronto, Ont.

Calcium Chloride—State Highway Comn., State House, Augusta, Me., will receive bids until Mar. 17 for 3,440 ton of flake calcium chloride.

Candy Factory—Clark Bros., Martindale St., Pittsburgh, Pa., is receiving bids for the construction of a 5 story, 58 x 80 ft. addition to candy factory. Estimated cost $100,000. P. Dietz, Lyceum Bldg., Pittsburgh, Pa., is engineer.

Canning Equipment — Mineral Point Canning Co., A. A. Schniur, Secy., Mineral Point, Wis., is in the market for pea and corn canning machinery and equipment to double capacity of plant.

Canning Plant — C. H. Dunn, Donna, Tex., plans the construction of a vegetable and produce canning plant. Estimated cost $22,000. Private plans. Complete machinery will be required.

Canning Plant—T. A. Howell, 1227 Park Ave., Beaumont, Tex., will soon receive bids for the construction of a canning plant at Orange, Tex. Estimated cost $15,000. Electrically operated equipment to cost $45,000 will be required.

Canning Plant—W. H. Stark & Associates. Orange, Tex., awarded contract for the construction of a fruit and vegetable canning plant, 125,000 cases annual capacity to F. A. Howell, Orange, Tex. Estimated cost $100,000. Complete equipment and machinery some electrically driven, will be installed.

Carbonizer Mill—W. Spink, Flatrock Rd. and Roxborough St., Philadelphia, Pa., plans the construction of a 3 story, 33 x 108 and 30 x 70 ft. carbonizer mill. Private plans.

Carbonization Process—Corporation, c/o M. J. O'Brien, Union Bank Bldg., Ottawa, Ont., Engr., plans the construction of two 1,000 ton low temperature carbonization process of Canadian slack coal plants, one to be at Ottawa and one at some other western point of Ontario, as soon as a federal charter for the corporation is obtained. Capital $3,000,000. Steps are being taken also for the organization of similar subsidiary companies in Montreal and Quebec and for similar plants.

Cement Plant—Atlantic Cement Products Corp., R. E. Eggleston, Pres., Concord Junction, Mass., will build a 1 story cement manufacturing plant on Conant St. Estimated cost $40,000. Private plans.

Cement Plant—Lawrence Cement Co., 302 Broadway, New York, N. Y., will build a cement plant by day labor at Thomaston, Me. Estimated cost $150,000. Burrell Engineering & Construction Co., 513 West Jackson Blvd., Chicago, Ill., is engineer.

Cement Plant — Volunteer Portland Cement Co., J. R. Hanahan, Pres., 21 Meeting St., Charleston, S. C., reported recently incorporated, capital $1,250,000, to establish a cement plant, 3,000 bbls. daily capacity, at Knoxville, Tenn.

Chemical Engineering Building — Iowa State College, Ames, Ia., will soon award contract for the construction of a 2 story chemical engineering building. Estimated cost $45,000.

Chemistry Building—Bd. of Trustees of Ohio State University, C. E. Steeb, Secy., Columbus, O., will receive bids until Mar. 22 for the construction of a 4 story, 60 x 160 ft., chemistry building on Campus. Estimated cost $300,000. J. N. Bradford, c/o owner, is architect.

Chemistry and Physics Laboratory Equipment — Bd. of Education, London, Ont., will receive bids until Mar. 21 for equipment for chemistry and physics laboratories for proposed new high school. Estimated cost $200,000.

Chemistry and Physics Laboratory Equipment—Bd. of Education, Bridgeburg, Ont., prices and catalogs on complete equipment for chemistry and physics laboratories for proposed new high school. Estimated cost $175,000.

Chloride of Lime, Soda Ash and Sulphate—P. J. Dooling, Comr. of Purchase, New York, N. Y., will receive bids until Mar. 16 for chloride of lime, soda ash and sulphate for Dept. of Water Supply, Gas & Electricity.

Chlorine, etc.—City Council G. F. Northrup, Pres., Toledo. O., has authorized the purchase of 30 ton of liquid chlorine and 100 ton of hydrated lime, etc., for Division of Water, Dept. of Public Service.

Coke and Gas Plant — Brooklyn Union Gas Co., 176 Remsen St., Brooklyn, N. Y., awarded contract for the design and construction of a by-product coke and gas plant with capacity of 1,750 tons of coal and 20,000,000 cu.ft. of gas per day, including 74 Becker combination coke and gas ovens, 9 Koppers gas producers with a complete coal and coke heating system and complete equipment for the recovery of by-products, to Koppers Construction Co., Union Trust Bldg., Pittsburgh, Pa.

Compressed Gas—Linde Air Products Co., 30 East 42nd St., New York, N. Y., awarded contract for the construction of a 1 story plant at Houston, Tex., to D. Hall, Cotton Exchange Bldg., Houston, Tex. Estimated cost $65,000.

Confectionery Factory—Moers, Ltd., 166 Adelaide St. W., Toronto, Ont., plans the construction of a confectionery factory. Estimated cost $250,000. Architect and engineer not selected.

Cyanide Mill — Presidio Mining Co., Presidio, Tex., is having plans prepared for the construction of a 300,000 ton cyanide mill at Shafter, Tex. Estimated cost $200,000. Private plans. All machinery for complete mill will be required.

Dextrine, Oils, etc.—Bureau of Engraving & Printing, Washington, D. C., will receive bids until Apr. 1 for dextrine, oils, textiles and dry colors during the fiscal year beginning July 1, 1927.

Drug Factory—G. M. Berringer Co. Inc., 501 Federal St., Camden, N. J., plans the construction of a 4 story, 40 x 145 ft. manufacturing plant at Fifth and Federal Sts. Estimated cost $150,000. J. C. Jefferies, 312 Market St., Camden, N. J., is architect.

Drug and Chemical Plant — McKesson-Robbins, Inc., Grassmere Ave., Fairfield, Conn., is receiving bids for the construction of a 5 story, 80 x 200 ft. drug and chemical plant. Estimated cost $200,000. Fletcher-Thompson, Inc., 542 Fairfield Ave., Bridgeport, Conn., is architect.

Dye Factory — Boston Dye House, 22 Eastern Ave., Malden, Mass., awarded contract for the construction of a 3 story dye factory at 253 Main St., to Canter Construction Co., 6 Beacon St. Estimated cost $40,000.

Dye House — The Brunsene Co., L. T. Sawyer, Pres., Stanley Ave., Watertown, Mass., is having preliminary sketches made for the construction of a dye house. Estimated cost $50,000. Private plans.

Enameled Iron Products, etc.—George D. Roper Corp., South Main St., Rockford, Ill., will soon receive bids for the construction of a 1 story, 170 x 170 ft. manufacturing plant, and 30 x 80 ft. power plant. Estimated cost $200,000. Private plans.

Flint and Spar Plant—Golding Sons Co., H. P. Margerum, Pres., Peace St., Trenton, N. J., plans the construction of a flint and spar plant, 2 units, 60 x 120 ft. each on New York Ave. Estimated cost $250,000. W. E. Dyer Co., Land Title Bldg., Philadelphia, Pa., is engineer.

Gas Plant—City of Belleville, Ont., plans extensions and improvements to gas plant. Estimated cost $185,000. Wynee-Roberts, Son & McClean, Metropolitan Bldg., Toronto, Ont., are engineers. Generating equipment will be required.

Gas Plant—New Britain Gas Co., A. H. Scott, Gen. Supt., Cherry St., New Britain, Conn., plans the construction of a 35 x 65 ft. gas plant, 1,500,000 ft. of gas daily capacity. Estimated cost $65,000.

Gas Plant (Coal)—Blackstone Valley Gas & Electric Co., Clinton St., Woonsocket, R. I., awarded contract for the construction of a coal gas plant at Pawtucket, R. I., to Stone & Webster, 147 Milk St., Boston, Mass.

Gas Compressor Plant — Interstate Natural Gas Co., Baton Rouge, La., will build a gas compressor plant and pipe line. Estimated cost $500,000. Ford, Bacon & Davis, Inc., Louisiana Bldg., are engineers in charge of construction.

Gasoline Plant—Phillips Petroleum Co., Bartlesville, Okla., plans the construction of a casinghead gasoline plant, 25 miles northwest of Abilene, Tex. Estimated cost $2,000,000. Private plans. Work will probably be done by owner's forces. Complete machinery will be required.

Glass Plant—Illinois Pacific Glass Co., 15th and Folsom Sts., San Francisco, Calif., awarded contract for the construction of an 80 x 230 ft. factory on Fruitland Ave., Los Angeles, Calif., to W. P. McNeil, 4814 Loma Vista Ave., Los Angeles, Calif. Estimated cost $30,000.

Kiln Building — Armstrong Cork Co., Beaver Falls, Pa., will build a 1 story, 180 x 220 and 60 x 120 ft. warehouse and kiln building. Estimated cost $80,000. Private plans. Work will be done by separate contracts.

Kiln Building—Vulcan Last Co., Antigo, Wis., plans the construction of a kiln building. Estimated cost $50,000. Architect not selected.

Laboratory—School Board, Amarillo, Tex., will soon award contract for the construction of second unit to high school including laboratory, etc., at 12th and Polk Sts. Estimated cost $250,000. E. F. Rittenberg, Blackburn Bldg., Amarillo, Tex. is architect.

Laboratory (Chemistry)—Bd. of Regents of State University of Wisconsin, Madison, Wis., will soon award contract for the construction of a 4 story, 40 x 200 ft. addition to chemistry building. A. Peabody, State House, Madison, Wis., is architect.

Laboratory Power Building—Bureau of Standards, Dept. of Commerce, Washington, D. C., plans the construction of a laboratory power building. Estimated cost $200,000.

Laboratory (Research) — The National Tube Co., Frick Bldg., Pittsburgh, Pa., awarded contract for a 2 story, 58 x 109 ft. research laboratory on Forbes St., to A. J. Wilson Co., 541 3rd Ave., Pittsburgh, Pa. Estimated cost $150,000.

Laboratories, etc.—City plans an election to vote $150,000 bonds for the construction of offices and laboratories for Dept. of Public Health.

Laboratories, etc.—The Pattern Foundry & Machine Co., R. L. Cawood, Pres., awarded contract for the construction of a 2 story, 50,000 sq.ft. building for general offices, engineering department, laboratories, experimental and pattern making departments, also 100,000 sq.ft. building for machine department. C. F. Clark, Const. Engr., in charge of construction.

Lead Pencil Factory — American Lead Pencil Co., 500 Willow Ave., Hoboken, N. J., awarded contract for the construction of a lead pencil factory to Turner Construction Co., 344 Madison Ave., New York, N. Y. Estimated cost $225,000.

Metal Polish Plant—G. E. Bennett Co., 291 10th St., San Francisco, Calif., had plans prepared for the construction of a 1 story, 30 x 95 ft. factory at Folsom and 10th Sts. L. H. Nishkian, Underwood Bldg., San Francisco, Calif., is engineer.

Milk Condensery—Alfred Ice Cream Co., 817 East 18th St., Los Angeles, Calif., awarded contract for the construction of a 1 story milk condensery at Tipton, Calif., to Shorb & Neads, Fresno, Calif. Estimated cost $50,800.

Milk Condensery — Detroit Creamery, Grand River and Cass Aves., Detroit, Mich., is having plans prepared for the construction of a milk condensery at Midland, Mich. Estimated cost $200,000. A. Kahn, 1000 Marquette Bldg., Detroit, Mich., is architect.

Oil Mill (Cotton Seed)—Lockney Cotton Oil Co., c/o M. D. Anderson, Lockney, Tex., is receiving bids for the construction of a cotton seed oil mill, 125 ton per 24 hrs. capacity. Estimated cost $250,000. R. J. Cummins, Bankers Mortgage Bldg., Houston, Tex., is engineer. Equipment including 6 hydraulic presses, 16 linters, seed handling equipment, etc., will be required.

Paint Factory—The Ferbert-Schondorfer Co., 12700 Elmwood Ave., Cleveland, O., manufacturers of paints and varnishes, awarded contract for the construction of a 2 story, 56 x 65 ft. factory, to The Austin Co., 16112 Euclid Ave., Cleveland, O. Estimated cost $50,000.

Paper Factory—Beveridge Paper Co., 717 West Washington St., Indianapolis, Ind., awarded contract for the construction of a 3 story, 115 x 130 ft. paper factory, to Mothershead & Fitton, 542 North Meridian St., Indianapolis, Ind. Estimated cost $90,000.

Paper Mill—Nicolett Paper Co., H. C. Hanke, Mgr., Du Pere, Wis., plans the construction of a 4 story addition to paper mill. Estimated cost $40,000. Architect not selected. New paper machines and equipment for the manufacture of glass and wax paper will be required.

Paperboard Mill—Canadian Paperboard Co., H. O. 2 Seigneurs St., Montreal, Que., plans the construction of a branch factory for manufacture of paperboard and cardboard at Toronto, Ont. Estimated cost $300,000. Kerry & Chace, Ltd., Confederation Life Bldg., Toronto, Ont., are engineers.

Pickle Factory—Crosse & Blackwell, 43 Front St. E., Toronto, Ont., awarded contract for the construction of a 2 story pickle factory on Fleet St., to Russell Construction Co., Harbor Bldg., Toronto, Ont. Estimated cost $500,000.

Pickle Plant—American Pickle Co., c/o The Wildar Mfg. Co., Cleveland, O., taking bids on revised plans about Mar. 1 for the construction of a 2 story, 160 x 680 ft. pickle plant at Hattiesburg, Miss. Estimated cost $100,000. E. C. Hearon & Sons, 201½ West Pine St., Hattiesburg, Miss., are architects.

Potato Curing Plant—Clarence Moore & Associates, Navasota, Tex., is having preliminary plans prepared for the construction of a sweet potato curing plant. Estimated cost including equipment $20,000.

Preserving Plants—M. G. Clymer Co. and Bert Clymer Co., 425 West Davis St., St. Louis, Mo., plan the construction of a system of preserving plants specializing in fig preserving and by-products, jellies, jams, butters, etc., at various cities, one central plant and smaller plants, will be established at probably Alvin, Dickinson and Webster, Tex. Estimated cost $2,000,000. Private plans. Machinery will be purchased for all plants.

Pulp and Paper Mill—Arkansas Paper & Pulp Co., 100 East 42nd St., New York, N. Y., subsidiary of the International Paper Co., will build a pulp and paper mill on the Ouachita River near Camden, Ark. Estimated cost $5,000,000. Private plans. Work will be done by separate contracts under the owner's supervision.

Refinery (Gypsum) — Windsor Gypsum Co., Windsor, Ont., will soon receive bids for the construction of a refinery, also storage bins, 100,000 ton capacity. Estimated cost $305,000. Complete machinery for refinery will be required.

Refinery (Oil) — Barkhusen Oil Co., Mather St., Green Bay, Wis., awarded contract for the construction of a 2 story, 60 x 85 ft. oil refinery, to H. J. Selmer Co., McCartney Bldg., Green Bay, Wis. Estimated cost $40,000.

Refinery (Oil)—Motor Fuel Products Co., c/o G. A. Camphius, Laredo, Tex., plans the construction of an oil cracking plant. Estimated cost $150,000. Private plans. Machinery will be required.

Refinery (Sugar)—Texas Sugar Refining Co., Sugarland, Tex., awarded contract for improvements to sugar refinery including warehouse 100,000 bags capacity, raw sugar bin and equipment, 5,000,000 lb. capacity, fuel economizers for each battery of boilers, to T. B. Hubbard, Bankers Mortgage Bldg., Houston, Tex. Estimated cost $250,000.

Roofing Plant — Certain-teed Products Corp., 100 East 42nd St., New York, N. Y., awarded contract for the construction of a 2 story, 109 x 145 ft. roofing plant at York, Pa., to Stofflet & Tillotson, 209 Wesley Bldg., Philadelphia, Pa.

Soda Ash, Sulphate of Alumina, etc.—W. L. Brown, Mgr., Tampa, Fla., will receive bids until Mar. 22 for water filtration supplies including 400 ton, 58% light soda ash, 1,200 ton, 17% ground sulphate of alumina, etc., to be delivered in carlots as needed during a period of one year.

Storage Battery Factory—Hobbs Storage Battery Co. Ltd., Federal Bldg., Toronto, Ont., is having plans prepared for the construction of a 3 story storage battery factory at Spadena Ave. and Fleet St. Estimated cost $100,000. A. J. Stringer, McLean Ave., Toronto, Ont., is architect.

Stove Factory — Roberts & Manders Stove Co., 11th St. and Washington Ave., Philadelphia, Pa., will soon award contract for the construction of a 3 story, 60 x 214 and 66 x 199 ft., and 1 story, 41 x 111 ft. stove factory at Hatboro, Pa. Private plans.

Syrup Factory—Pacific Coast Syrup Co., 73 Sansome St., San Francisco, Calif., is having plans prepared for the construction of a 6 story factory at Sansome and Pacific Sts. Estimated cost $200,000. D. A. Riedy, Pacific Bldg., is architect.

Tallow Factory—California Tallow Co., 1236 Evans Ave., San Francisco, Calif., plans to rebuild tallow factory recently destroyed by fire. Cost will exceed $40,000.

Tannery—Lynn Tanning Co., 53 Boston St., Lynn, Mass., is having plans prepared for the construction of a tannery. Estimated cost $40,000. J. Schwartz, 25 Central Ave., Lynn, Mass., is architect.

Tire and Rubber Factory—National Tire & Rubber Co., East Palestine, O., plans the construction of a 2 story, 40 x 120 ft. factory to double the capacity of the plant. Estimated cost $40,000.

Wire and Cable Buildings—E. F. Phillips Electrical Works, 12 Mercer St., Toronto, Ont., plans the construction of two 1 story wire and cable manufacturing buildings, one for cotton covering department and one for enameled wire department at Brockville, Ont. Estimated cost $200,000. J. M. Miller, 364 Dorchester St. W., Montreal, Que., is architect.